MODEL PEI 2000A
DIGITAL SAFETY ANALYZER

OPERATING AND SERVICE MANUAL

MP MASTER
MA35010

DYNATECH NEVADA
INCORPORATED

Formerly NEURODYNE-DEMPSEY

2000 ARROWHEAD DRIVE, P.O. BOX 1925
CARSON CITY, NEVADA 89701, (702) 883-3400

Return to
Test Dept.

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ISO-POWER TEST MODULE (Optional) MODEL 201A

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General Specifications
Preparation for Use
Operating Instructions
Simplified Schematics
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1 - 1. INTRODUCTION

The Model 2000A is a versatile autoranging digital electrical safety analyzer useful for measurement of electrical hazards in the health care facility. Test functions are conveniently selected with push-button switches. Patient leads can be scanned automatically or manually for leakage current values. All testing is conducted according to the 1975 AAMI input impedance load standard. Modular construction is used throughout for ease of calibration and maintenance. The Model 2000A is completely self-contained in a compact carrying case with removable lid.

1 - 2. SPECIFICATIONS

TEST SPECIFICATIONS

LINE VOLTAGE/RECEPTACLE WIRING TEST

RANGE: 0 - 199 Volts

DISPLAY: Digital display flashes for:

Open ground
Hot-neutral reversal

TEST CURRENT: 15 microamps max.

ACCURACY: ± (1.0% reading + 1 digit)

INSULATION TEST

LED glows when power side insulation of equipment wiring to ground less than 1.0 megohm.

Short circuit current less than 100 microamps.

"OFF" position of polarity switch programs test.

ACCURACY: ± 1.5%

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LED glows when power side insulation of equipment wiring to ground less than 1.0 megohm.

Short circuit current less than 100 microamps.

"OFF" position of polarity switch programs test.

ACCURACY: ± 1.5%

TEST SPECIFICATIONS (cont'd)

GROUNDING RESISTANCE TEST

RANGE: 0 - 19.99 ohms

MEASURES: Resistance of ground conductor in power cord.

Ground resistance between two receptacles.

PUSH-BUTTON SWITCH PROGRAMS TEST.

DISPLAY: display flashes for overrange indication

ACCURACY: ± (1.0% reading + 1 digit)

LEAKAGE CURRENT TEST

AUTOMATICALLY
SWITCHED RANGES OF:

0 - 199.9 microamps/millivolts
200 - 1999 microamps/millivolts

DISPLAY: Display flashes for overrange indication.

INPUT IMPEDANCE: 1000 ohm ± 0.3%
1975 AAMI type load

FREQUENCY RESPONSE: D.C. to 1.0 megahertz

ACCURACY: ± (1.0% reading + 1 digit)

Push-button function switches program the analyzer for the following leakage conditions:

Case to ground
Leads to ground
Lead to Leads
Isolation of leads to line voltage
External measurement with test probes

Additional push-button control for:

Automatic or manual scan of leads
All or single lead selection
Open ground to receptacle
D.C. only component

LED indication of lead under test.

LED indication if line fault encountered in Resistance, Case to ground, and Probes external modes.

TEST SPECIFICATIONS (cont'd)

ISOLATED POWER SYSTEM TEST------OPTIONAL PLUG-IN MODULE

MODEL 201A

Measures leakage or trip current in Line 1 or Line 2 with a range of:

0 - 150 milliamps

Simulates fault current in Line 1 or Line 2 with a range of:

0.5ma to 5.0ma.

GENERAL SPECIFICATIONS

DISPLAY

3½ Digits, 0.43" High.
Seven segment, red LED.
Resolution: 1 part in 2000.

INPUT JACKS

Five way with indication of EKG lead type & color.

TEST RECEPTACLE

High abuse nylon.
Hospital grade.
15 amp - 125 volt.
U.L. Listed.

FUSES

Test receptacle:
10A - 115V (Slo-blo)
1½A - 115V (ground)

Meter & Power Supply:
½A - 115V (Slo-blo, internal)

Resistance circuit:
½A - 115 (Fast-blo)

TEST LEADS

Two--four feet long.
Black and red.
Alligator adaptors.

POWER CORD

Type SJT.
Six feet long.
Three conductor.
Hospital grade plug.
U.L. Listed.

POLARITY REVERSING SWITCH

15A - 125V
Center "OFF".
U.L. Listed.

POWER "ON" SWITCH

15A - 125V
U.L. Listed.

CALIBRATION JACKS

Current: 10 microamps ± 1.5%
Resistance: 0.5 ohms ± 1.5%

PHYSICAL

Case of wood grain melamine plastic.

Top & Back Panel of .090" aluminum with hard epoxy finish.

Weight:
8.5 lbs. approx.
3.9 kg approx.

Size:
3.75"H X 8.5"W X 10.75"L
(9.53 X 21.6 X 27.3 cm.)

1 - 3. WARRANTY

P.E.I., INC. warrants each of our products to be free from defects in material and workmanship. Our obligation under this warranty is to repair or replace any instrument or part thereof which, within a year after shipment, proves defective upon examination.

To exercise this warranty contact P.E.I. headquarters in Philadelphia, Pennsylvania and you will be given prompt assistance and shipping instructions.

1 - 4. REPAIRS AND CALIBRATION

P.E.I. maintains a complete repair and calibration service in Philadelphia, Pennsylvania. To insure prompt repair or recalibration service please contact our headquarters directly before returning the instrument. Estimates for repairs and recalibrations are available upon request.

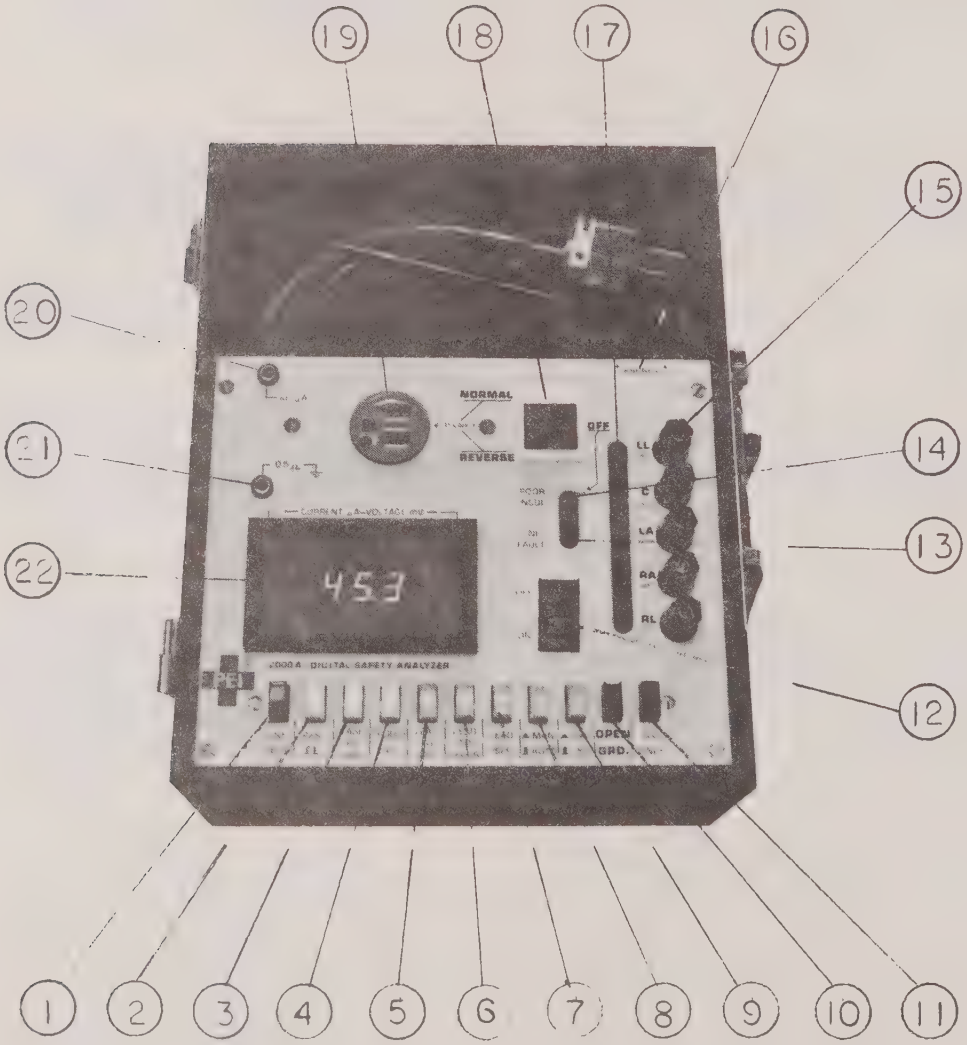
When returning an instrument to P.E.I. please include the model number, serial number, return address, and required services on an attached memo or tag.

Use the original carton and packaging material for reshipment if available. If this is not possible pack the instrument in a carton of sufficient strength for the weight that is being shipped. Use at least 3 - 4 inches of tightly packed shock absorbing material around the instrument.

1 - 5. INCOMING INSPECTION.

The shipping carton should be checked for damage as soon as received. Contact the carrier or his agent if there is any evidence of damage and request his presence when unpacking the instrument. Inspect the instrument for evidence of physical damage. Next, check whether the instrument operates within specified limits (See Section 2 - 2. for performance checks). Notify P.E.I. headquarters for help in settling claims.

2-1. DESCRIPTION OF CONTROLS



2 - 1. DESCRIPTION OF CONTROLS

Item No.	Name	Function
1.	LINE TEST	Checks the outlet in which the 2000A is connected for line voltage, proper polarity, and presence of ground.
2. thru 7.	FUNTION SWITCHES	Programs the 2000A for the following tests: Resistance of case to u-blade Case to ground leakage Leakage using external test probes Lead to ground leakage Leakage between leads Isolation of leads to line voltage
8.	MANUAL OR AUTO	Programs the 2000A automatic scan of patient leads under test or manual stepping from lead to lead.
9.	ALL LEADS/MAN. STEP	When depressed, all lead leakage is measured and if function switch 8. is in Manual mode the measurement circuit is advanced one step.
10.	OPEN GROUND	Removes the ground from the 2000A test receptacle.
11.	D.C. ONLY	When depressed separates the D.C. leakage components.
12.	POWER SWITCH	Turns the 2000A on and off.
13.	LINE FAULT	LED glows if line fault encountered in RES (¼A fuse protected), CASE TO GRD, and PROBES EXT. modes.
14.	POOR INSULATION	LED glows if power side insulation of equipment under test is less than 1.0 megohm. "OFF" position of polarity switch programs test.
15.	INPUT JACKS	Five, for patient leads under test.
16.	PROBES	Red and black test leads are connected for external testing.
17.	LEAD UNDER TEST	LED glows beside the lead under test.
18.	POLARITY SWITCH	Switch reverses the polarity to equipment under test. Center OFF.
19.	RECEPTACLE	Supplies power to equipment under test.
20.	CURRENT TEST JACK	Checks calibration of 2000A - 10 uA.
21.	RESISTANCE TEST JACK	Checks calibration of 2000A - 0.5 ohm.
22.	DIGITAL PANEL METER	Displays value of measured parameter.

2 - 2. PREPARATION FOR USE - PERFORMANCE CHECKS

1. The 2000A line cord should be plugged into a properly wired receptacle and the power switch turned ON.
2. Depress LINE TEST function switch and observe line voltage reading. (105 to 125 volts depending on locality.)
3. Depress RES function switch. Connect red probe to back panel jack and the 0.5 ohm test jack on top panel. Reading should be 0.5 ohm ± 0.02 ohms. Look for flashing display when red probe is disconnected from jack.
4. Depress CASE TO GRD function switch. Connect red probe to back panel jack and 10 uA test jack. Reading should be 10 uA ± 0.2 uA.
5. Depress PROBES EXT function switch. Connect red test probe between 10 uA test jack and back panel jack. Reading should be 10 uA ± 0.2 uA.
6. Depress LEAD TO GRD function switch. Connect the red test probe between the 10 uA test jack and a patient lead binding post with a LED indication beside it. The reading should be 10 uA ± 0.2 uA. This procedure may be repeated for each lead position.
7. Depress LEAD TO LEADS function switch. Repeat step 6. procedure.

The above testing procedure thoroughly checks most of the active measurement networks of the MODEL 2000A.

A quick daily check might include steps 3. & 5. only.

FORM P-20

PEI

EKG ELECTRICAL SAFETY TEST WITH MODEL 2000A

INSTR. MFGR. | DATE

MODEL NO. | TESTED BY

SERIAL NO. | CONTROL NO.

LOCATION

TEST NO.	TEST	SWITCH SETTINGS ☐-DENOTES SWITCH	RESULTS
1	LINE VOLTAGE-RECEPTACLE WIRING	LINE TEST	PASS____ FAIL____ VOLTS____V
2	POWER SIDE INSULATION	POL. SW. OFF — EUT POWER ON/POWER OFF	PASS____ FAIL____
3	CASE TO U-BLADE RESISTANCE	RES. Ω — POL. SW. OFF	TOUCH RED PROBE TO EUT CASE ____ ____Ω
4	CASE TO GROUND LEAKAGE	CASE TO GRD. — EUT PWR. ON/OFF: GROUNDED — NOR.POL. — RED PROBE TO EUT CASE ____uA; OPEN GRD — NOR.POL. — " " " ____uA; REV.POL. — " " " ____uA	
5	LEAD TO GROUND LEAKAGE	LEAD TO GRD. — NOR. POL.: GROUNDED: HIGH LEAD ____ µA ____; ALL LEADS ____ µA; OPEN GRD.: HIGH LEAD ____ µA ____; ALL LEADS ____ µA — REV. POL.: GROUNDED: HIGH LEAD ____ µA ____; ALL LEADS ____ µA; OPEN GRD.: HIGH LEAD ____ µA ____; ALL LEADS ____ µA	LEAD:
6	LEAKAGE BETWEEN LEADS	LEAD TO LEADS — REV. POL. — GROUNDED/OPEN GRD. — HIGH LEAD ____ µA ____; NOR. POL. — GROUNDED/OPEN GRD. — HIGH LEAD ____ µA ____	
7	ISOLATION OF LEADS TO LINE VOLTAGE	LEAD ISO. — NOR. POL.: EUT PWR.ON — HIGH LEAD ____ µA ____; EUT PWR.OFF — HIGH LEAD ____ µA ____	

(PRINT COMMENTS ON REVERSE SIDE)

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CAUTION Disconnect all equipment within possible contact of patients with indwelling catheters.
A test failure at any point in Steps 1. through 3. must be corrected before proceeding with further testing.

1. LINE VOLTAGE/RECEPTACLE WIRING

Plug 2000A line cord into receptacle and turn power switch ON. Depress LINE TEST function switch and read line voltage. A flashing display indicates: hot-neutral reversal; open ground; or a low voltage condition. A flashing (+) plus sign with a voltage indication of less than 85 volts indicates a blown ground fuse in the 2000A.

2. POWER SIDE INSULATION

Turn POLARITY SWITCH of 2000A to OFF position. Plug EUT into orange receptacle of 2000A. Poor insulation LED will glow if combined hot and neutral resistance to ground is less than 1.0 megohm. Very often a ground-neutral short in the EUT is the cause for this indication. Reversing the polarity will blow the ground fuse in the 2000A. Refer to Step 1.

-- A FLASHING DISPLAY IN TESTS 3 - 8 INDICATES OVERRANGE --

3. CASE TO U-BLADE RESISTANCE

Depress RES function switch. Touch red test probe of 2000A to exposed case metal of EUT. Display indicates resistance directly with 0.01 ohm resolution.

4. CASE TO GROUND LEAKAGE

Depress CASE TO GRD function switch. Touch red test probe of 2000A to exposed case metal of EUT. Refer to PEI test form P-20 for POL., OPEN GRD, and EUT pwr. switch settings.

5. LEAD TO GROUND LEAKAGE

Connect EUT leads to binding posts of 2000A. Depress LEAD TO GRD function switch. Select either MAN or AUTO lead scan mode. Refer to PEI test form P-20 for various POLARITY and OPEN GRD switch settings.

6. LEAKAGE BETWEEN LEADS

Depress LEAD TO LEADS function switch. Select either MAN or AUTO lead scan mode. Refer to PEI test form P-20 for various POLARITY and OPEN GRD switch settings.

7. ISOLATION OF LEADS TO LINE VOLTAGE

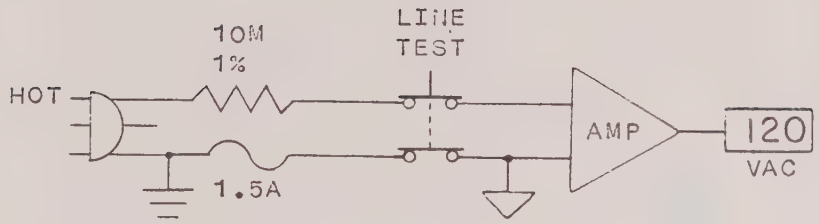
Depress LEAD ISO function switch. Select either MAN or AUTO lead scan mode. Refer to PEI test form P-20 for various POLARITY and EUT power switch settings.

8. LEAKAGE USING EXTERNAL PROBES

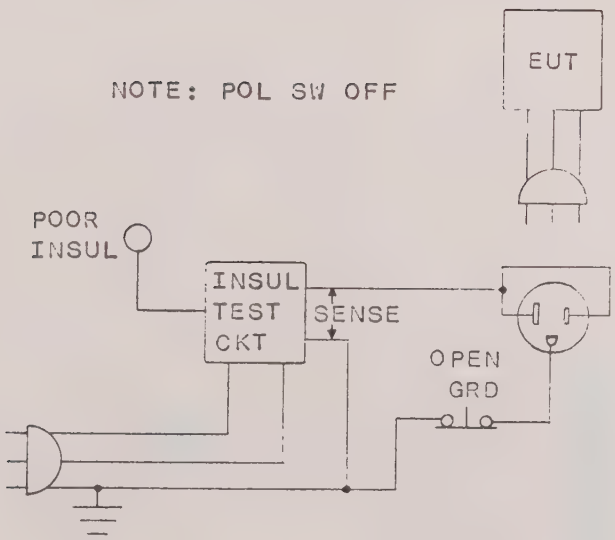
Depress PROBES EXT function switch. Use black and red test probes to measure leakage current or differential voltage between any conductive surfaces.

NOTE "EUT" designates EQUIPMENT UNDER TEST in above text. Line fault LED glows for fault encountered in RES, CASE TO GRD, and PROBES EXT testing.

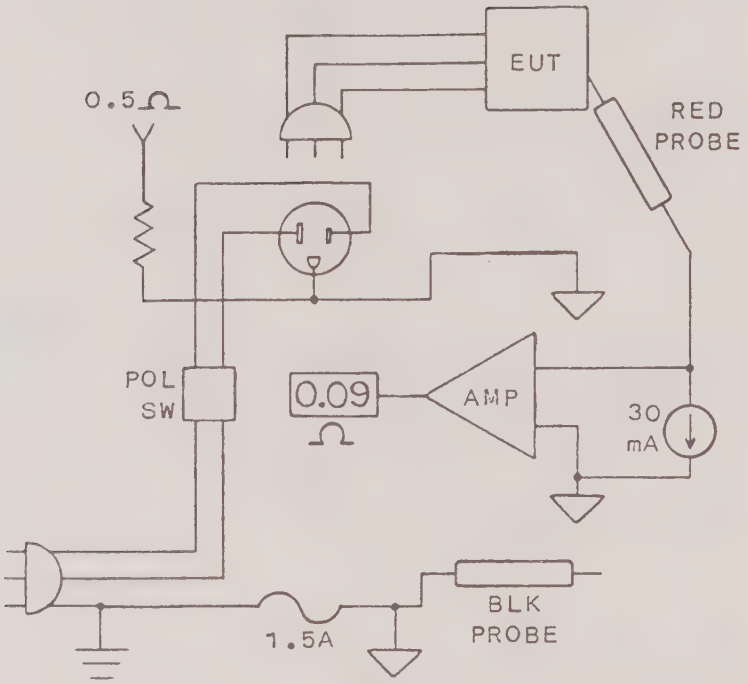
2-5. SIMPLIFIED SCHEMATICS



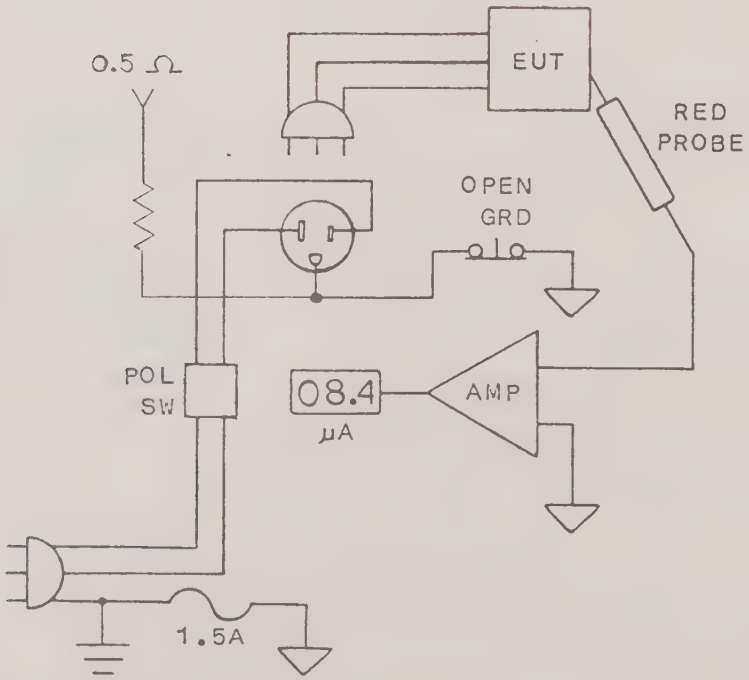
1. LINE VOLTAGE/RECEPTACLE WIRING



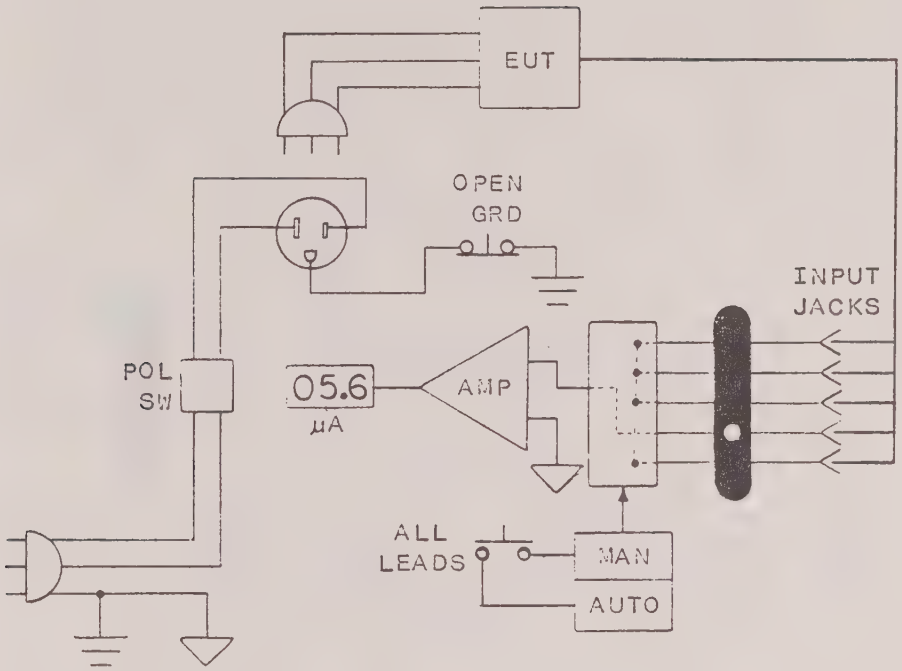
2. POWER SIDE INSULATION



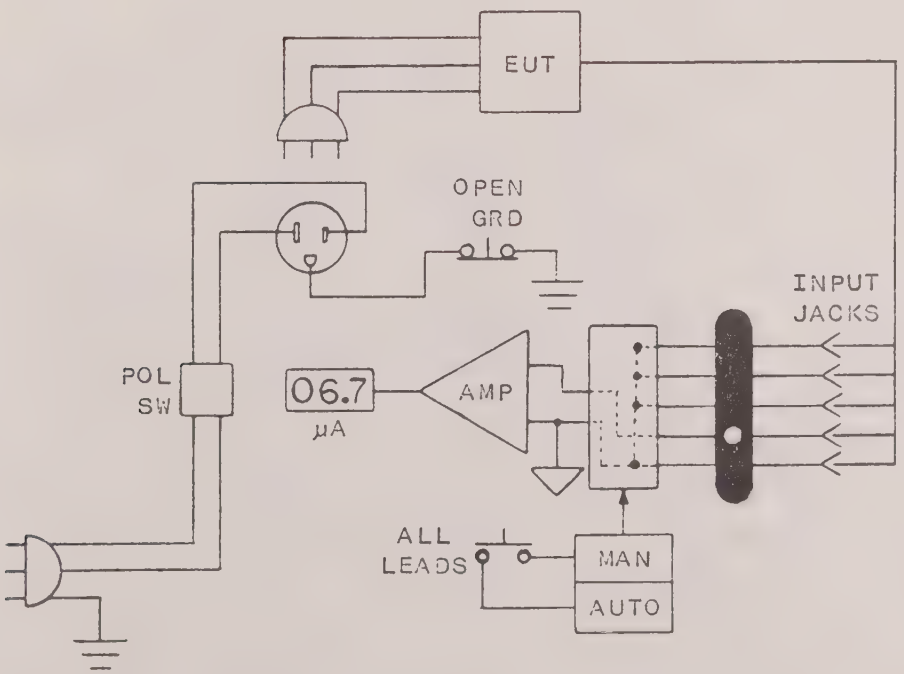
3. CASE TO U-BLADE RESISTANCE



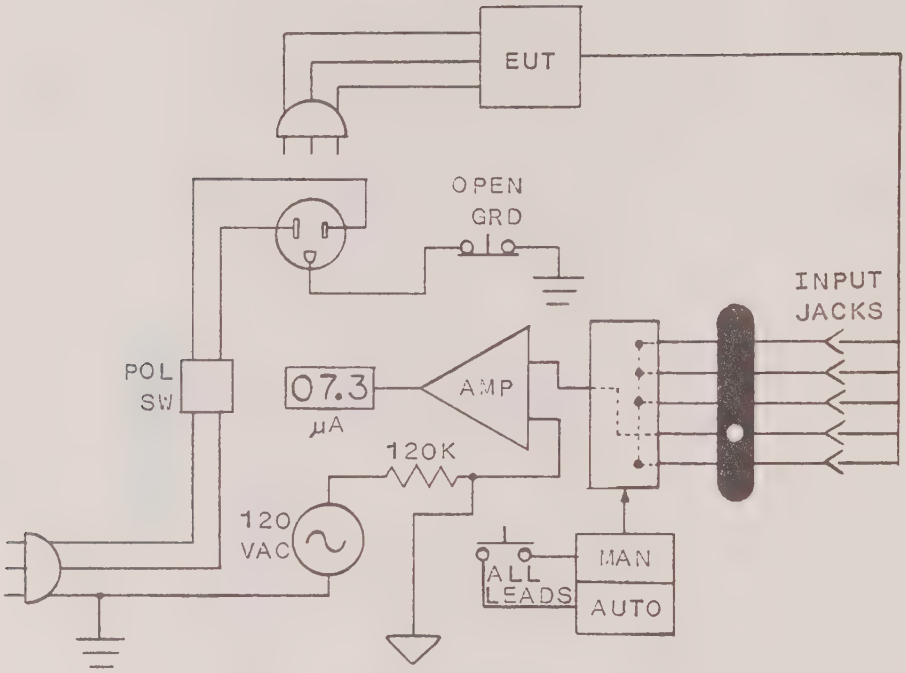
4. CASE TO GROUND LEAKAGE



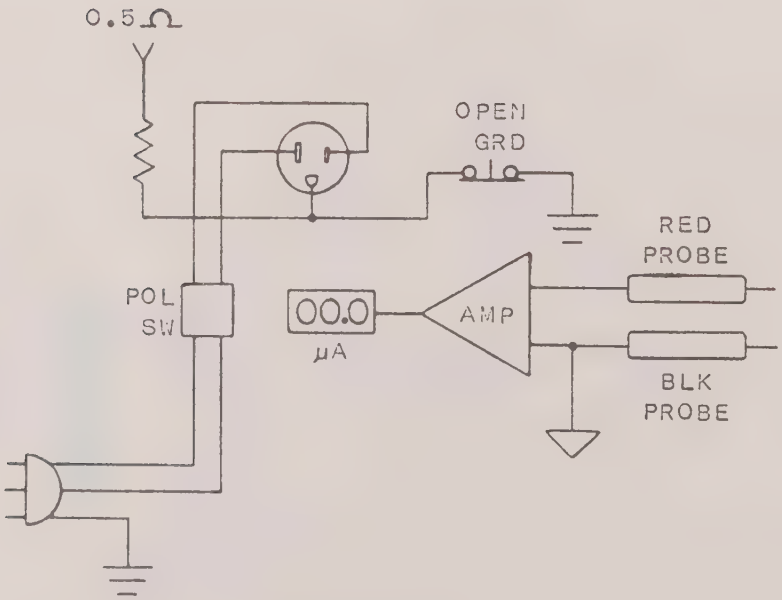
5. LEAD TO GROUND LEAKAGE



6. LEAKAGE BETWEEN LEADS



7. ISOLATION OF LEADS TO LINE VOLTAGE



8. LEAKAGE USING EXTERNAL TEST PROBES

3 - 1. USEFUL PUBLICATIONS

ELECTRICITY IN PATIENT CARE FACILITIES
NFPA Bulletin #76B-T
Write: National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

SAFE CURRENT LIMITS STANDARD (PROPOSED)
AAMI STANDARD #SCL-P 10/75
Write: Association for the Advancement
of Medical Instrumentation
1901 N. Ft. Myer Drive
Suite 602
Arlington, VA 22209

INHALATION ANESTHETICS
NFPA Bulletin #56A
Write: National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

NATIONAL ELECTRICAL CODE 1975
NFPA #70-1975
Write: National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

FUNCTIONAL SAFETY AND SANITATION
(Standards adopted December 1975)
Write: Joint Commission on Accreditation
of Hospitals
875 North Michigan Avenue
Chicago, IL 60611

STANDARD FOR SAFETY (Medical & Dental Equipment)
UL 544
Write: Underwriters Laboratories, Inc.
1285 Walt Whitman Road
Melville, L.I., NY 11746

ELECTRICAL SAFETY IN HEALTH CARE FACILITIES
Roth, Teltscher, & Kane
Published by: Academic Press, Inc.
111 Fifth Avenue
New York, NY 10003

3 - 2. TABLE OF VARIOUS STANDARDS
3 - 3. P.E.I. RECOMMENDED TESTING STANDARDS

STANDARD	LEAKAGE CURRENT in uA			GROUND WIRE RESISTANCE	POWER SIDE INSULATION RESISTANCE
	Critical Care	General Care	Non Patient		
NFPA 76B-T					
CHASSIS	100	100	500	0.15 OHMS	GREATER THAN 1.0 MEGOHM
NON ISO LEAD	50	-	-		
ISO LEAD	10	-	-		
AAMI 10/75					
CHASSIS	100	100	500		
NON ISO LEAD	50	-	-		
ISO LEAD	10	-	-		
U.L. 544					
CHASSIS	100	-	-	0.10 OHMS	
NON ISO LEAD	50	-	-		
ISO LEAD	10	-	-		
P.E.I. (Recommend)					
CHASSIS	100	100	500	0.15 OHMS	GREATER THAN 1.0 MEGOHM
NON ISO LEAD	50	50	-		
ISO LEAD	10	10	-		

SECTION 4

REQUIRED TEST EQUIPMENT

1. Multimeter with accuracy specification $\leq$ 0.5% of reading.
2. 0 - 1000. uA DC current source.
3. 0 - 1000. uA AC current source.
4. 0 - 1.MΩ decade resistance box.

REQUIRED ADJUSTMENT TOOLS

1. 10" long insulated alignment tool with 1/8" flat blade at tip.
2. 1/16" wide flat blade insulated screwdriver.
3. 4" jumper wire with alligator clips attached.

REMOVAL OF CHASSIS FROM CASE

To remove the chassis from the case, it is necessary to first remove the two screws and nuts located at the bottom of the back panel. Next, remove the four screws located at the corners of the top panel.

Grasp the binding posts and slowly lift the chassis straight up and out of the case.

Reassembly is the reverse of the above procedure.

CAUTION: Insure that no bodily contact is made with any portion of the interior of the chassis, including the circuit boards, while the chassis is energized as an electric shock may result. Every circuit board contains an area which may be energized at line voltage potential.

GENERAL INFORMATION

The calibration procedure deals only with those circuit parameters and functions which are adjustable. To check the operation of those portions which are non-adjustable, it will be necessary to refer to section 2 - 2. -- Preparation for Use -- performance checks.

To facilitate the location of calibration adjustments on the main circuit board, Fig. 4 - 1 has been provided. The arrows indicate the direction from which the alignment tool must be used.

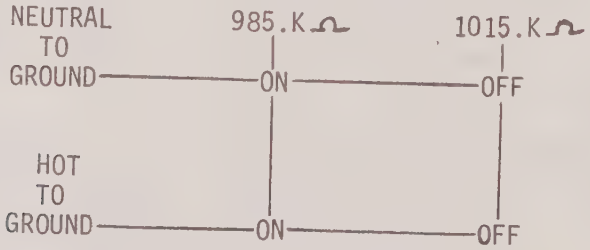
The Cal. SOCKET, located on the main circuit board, is provided to facilitate the monitoring of various adjustable parameters within the amplifier and power supply while performing the AMPLIFIER CALIBRATION section 4 - 2.

Fig. 4 - 2 and 4 - 3 are representative of the views of the individual function switches as seen from the front of the chassis.

4 - 1. POOR INSULATION TEST CALIBRATION

1. Insure that the chassis is de-energized.
2. Remove the main circuit board.
3. Place polarity switch in OFF position.
4. Set the decade resistance box to 1.MΩ and connect it between the NEUTRAL slot on the test receptacle (Fig. 4 - 4) and any exposed metal on the chassis.
5. Locate the square adjustment potentiometer mounted on the "T" shaped circuit board located directly under the top panel.
6. Energize the chassis and adjust the potentiometer until the POOR INSUL. light illuminates.
7. Slowly rotate the adjustment in the opposite direction until the light goes out.
8. Insure that the POOR INSUL. light responds to the settings on the decade resistance box as indicated by the table below.

DECADE RESISTANCE BOX SETTING



9. De-energize the chassis and re-install the main circuit board.

4 - 2. AMPLIFIER CALIBRATION

(Refer to Fig. 4 - 1 for CAL. SOCKET and various RV locations.)

1. Depress PROBES EXT. function switch.
2. Attach an ohmeter to the red and black PROBE jacks,and adjust RV3 for a value of 1000. ± 2. ohms.
3. Disconnect the ohmeter from the probe jacks.
4. Place a jumper across the pins of the D.C. ONLY function switch as shown in Fig. 4 - 2.

NOTE: Energize the chassis for five minutes before proceeding with the calibration procedure. Also, allow 30 seconds after each adjustment to insure that the new setting has stabilized.

AMPLIFIER CALIBRATION (cont'd)

5. Connect a 0.01V resolution 0-10.V DC voltmeter between pins 5 and 8 on the CAL SOCKET. Insure that the positive input to the voltmeter is attached to pin 5 and the negative input is attached to pin 8.
6. Adjust RV1 for a value of 6. ± .02V on the voltmeter.
7. Carefully disconnect the voltmeter from pins 5 and 8 on the CAL SOCKET and reconnect it to pins 7 and 8. Insure that the positive input to the voltmeter is attached to pin 8 and the negative input attached to pin 7.
8. Adjust RV2 for a value of 6 . ± .02V on the voltmeter.
9. Disconnect the 0-10.V DC voltmeter from the CAL SOCKET.
10. Connect a 0.1 mV resolution DC millivoltmeter between pins 6 and 8 on the CAL SOCKET. Insure that the positive input to the millivoltmeter is attached to pin 6 and the negative input attached to pin 8.
11. Adjust RV4 for a value of 0.V on the millivoltmeter.
12. Disconnect the positive input to the millivoltmeter from pin 6 and reconnect it to pin 4.
13. Adjust RV5 for a value of 0.V on the millivoltmeter.
14. With the millivoltmeter still connected, apply a DC current of 10.0 uA to the red and black PROBE jacks. Insure that the current source polarity matches the PROBE jack polarity (+ to red, - to black).
15. Adjust RV6 for a value of 100.0 mV on the millivoltmeter.
16. Note the indication on the 2000A display. Reverse the DC current source polarity and adjust RV8 until the same indication is noted.
17. Disconnect the positive input to the millivoltmeter from pin 4 and reconnect it to pin 2.
18. Disconnect the DC current source from the PROBE jacks, and adjust RV7 for an indication of 0.V on the millivoltmeter.
19. Reconnect the DC current source as in step 14.
20. Locate the panel meter adjustment screw on the vertical board at the left side of the 2000A. Apply 10.0 uA and 100.0 uA DC to the 2000A and adjust the screw until both readings are displayed within the specified accuracy.
21. Recheck steps 16 through 20. to insure that possible readjustment is not required.
22. Apply 1000 uA DC to the red and black PROBE jacks, and adjust RV9 for an identical indication on the display.
23. Disconnect the current source and de-energize the chassis.

4 - 3. LINE TEST CALIBRATION

(Performed only after AMPLIFIER CALIBRATION)

1. Depress the PROBES EXT. function switch.
2. Place a jumper across the pins of the LINE TEST function switch as indicated in Fig. 4 - 3.
3. Apply a 10.0 uA AC source to the red and black PROBE jacks.
4. Energize the chassis and adjust RV 11 until a flashing plus sign (+) just appears at the left portion of the display.
5. De-energize the chassis, remove the jumper wire from the function switch, and disconnect the current source.

4 - 4. RESISTANCE CIRCUIT CALIBRATION

(Performed only after AMPLIFIER CALIBRATION)

1. Depress RES.Ω function switch.
2. Attach a DC ammeter to the red and black PROBE jacks.
3. Energize the chassis, and adjust RV10 for an indication of 30.0 mA on the ammeter. (Insure that the 2000A display is not flashing, as this indicates that the ammeter input resistance is too great.)
   If a value of 30.0 mA can't be obtained, check the ¼-A fuse to insure that it is intact and is of the proper type as indicated on the parts list.
4. Plug the red probe into the red PROBE jack and the 0.5Ω test jack.
5. Allow the display to stabilize, and if needed, adjust the display indication to 0.50 by inserting a small screwdriver through the adjustment hole located below and between the red and black PROBE jacks.
6. Disconnect the red probe and de-energize the chassis.

4 - 5. LEAD ISO. OFFSET ADJUSTMENT

(Performed only after AMPLIFIER CALIBRATION)

1. Depress the LEAD ISO. function switch, and energize the chassis.
2. With no leads attached to the patient lead binding posts, locate and adjust RV12 for a minimum indication on the display.
3. De-energize the chassis.

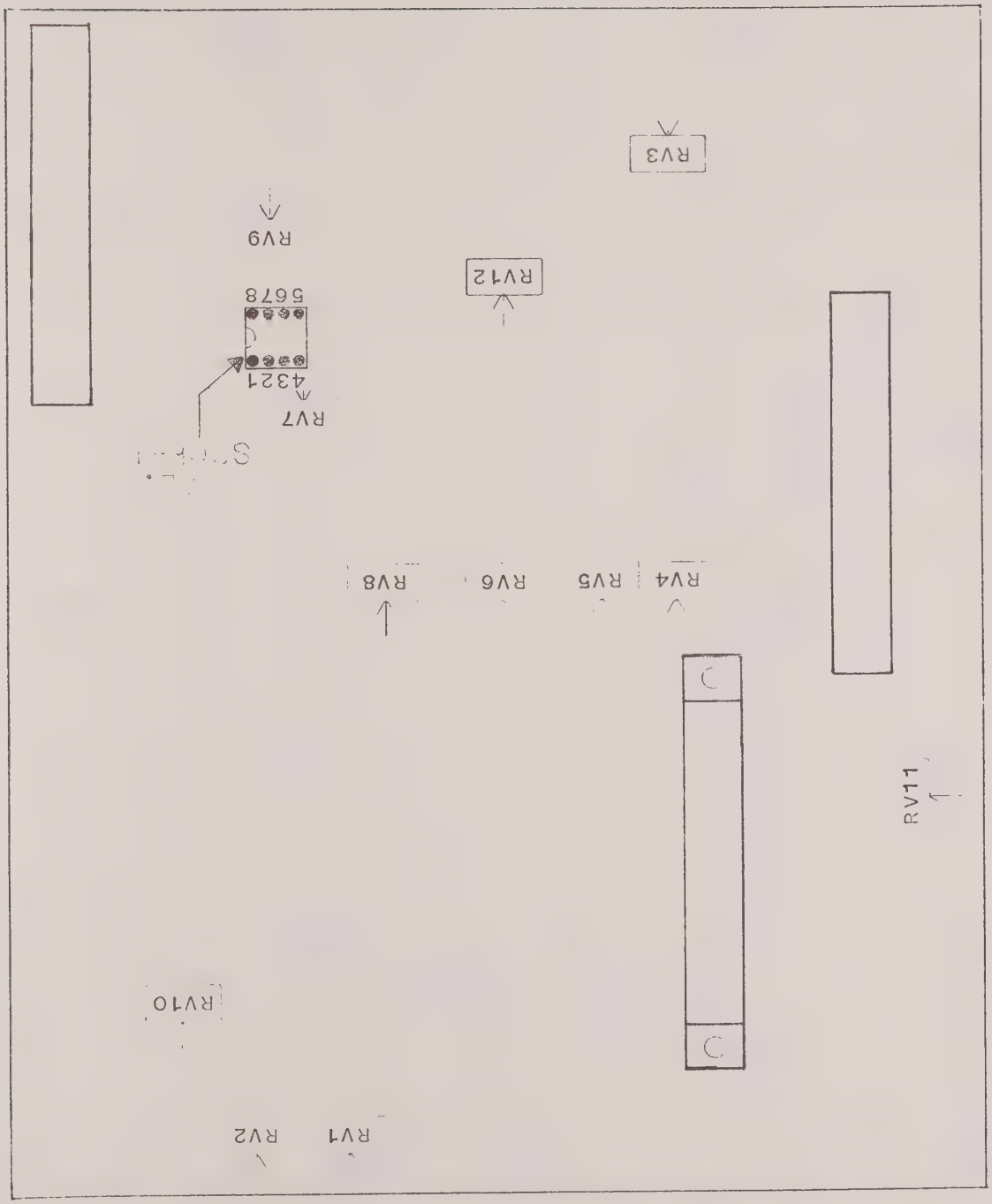


Fig. 4-1 MAIN BOARD CALIBRATION ADJUSTMENT LOCATIONS.

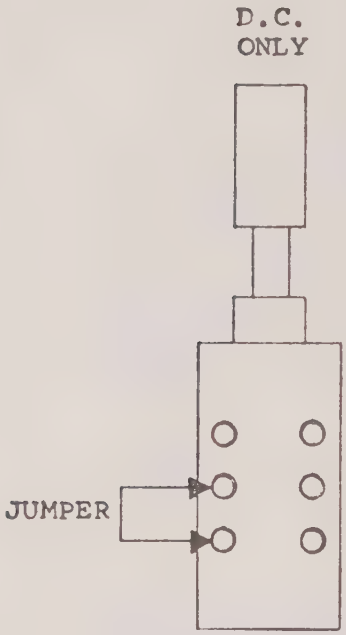


Fig. 4-2

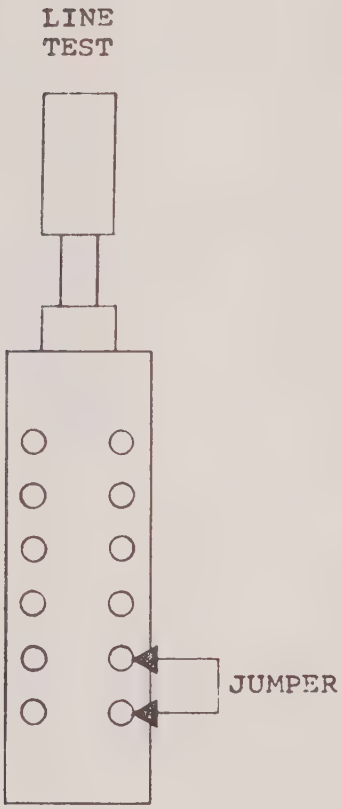


Fig. 4-3

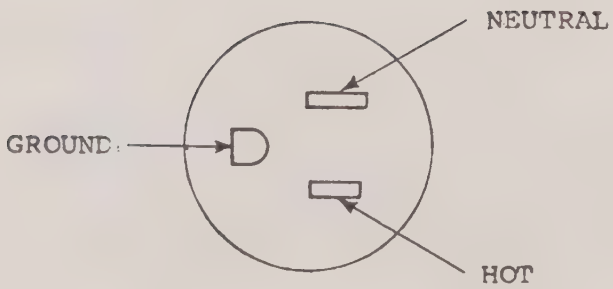
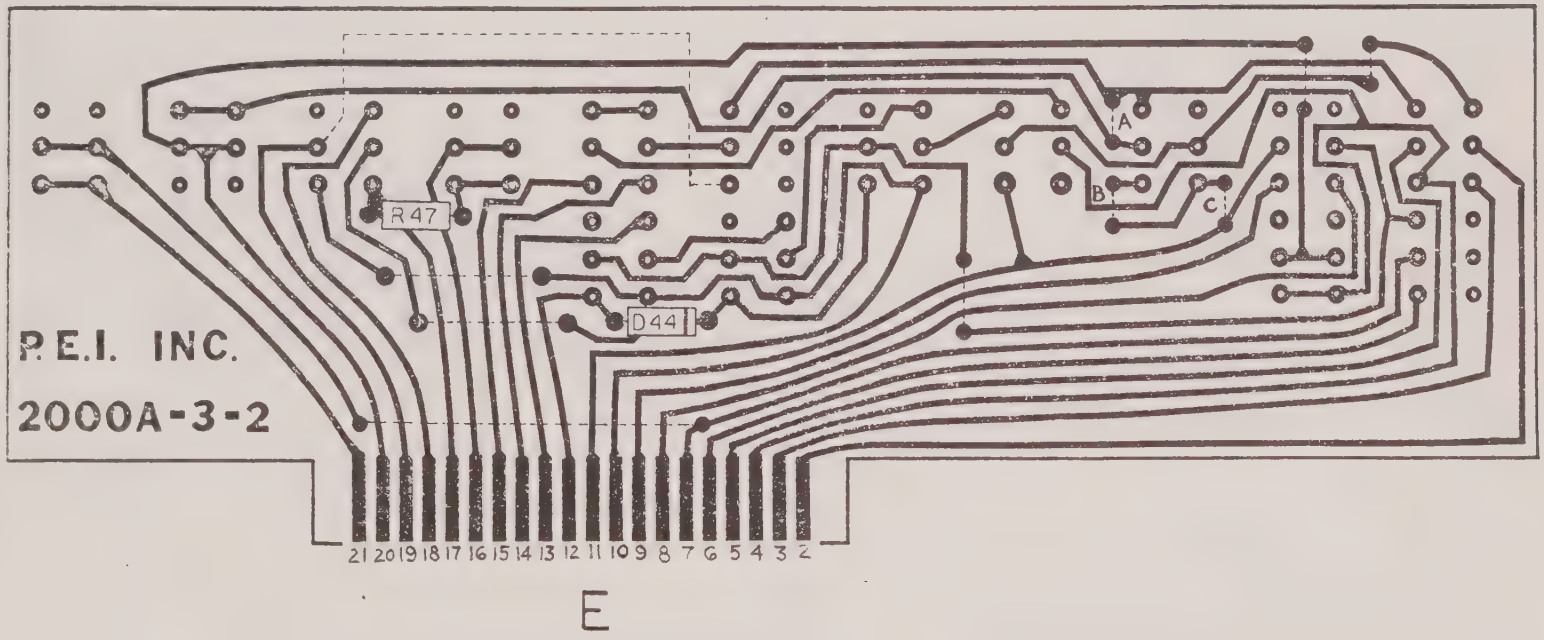


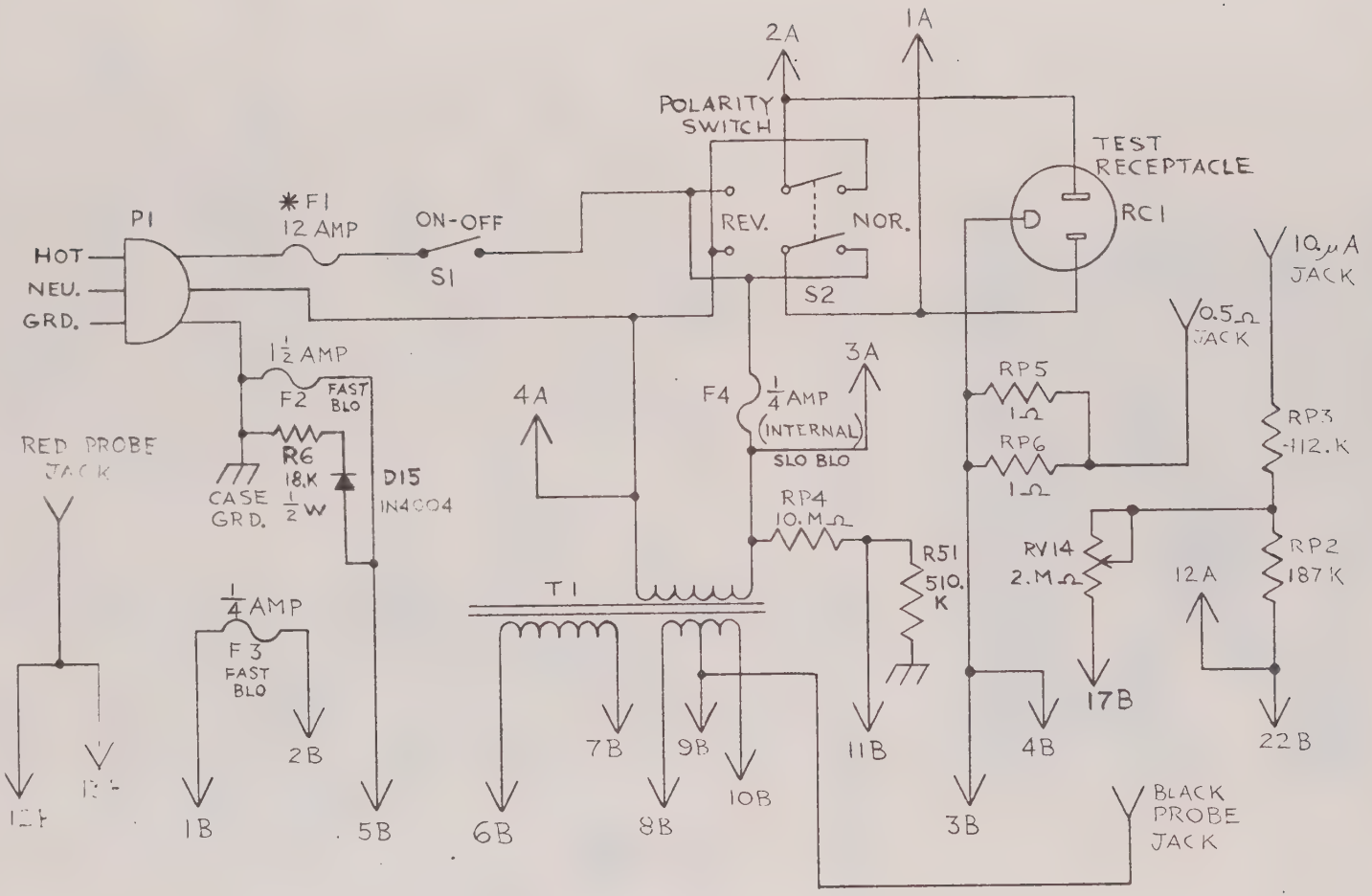
Fig. 4-4

5-1. [illegible] BOARD CONNECTOR LOCATIONS

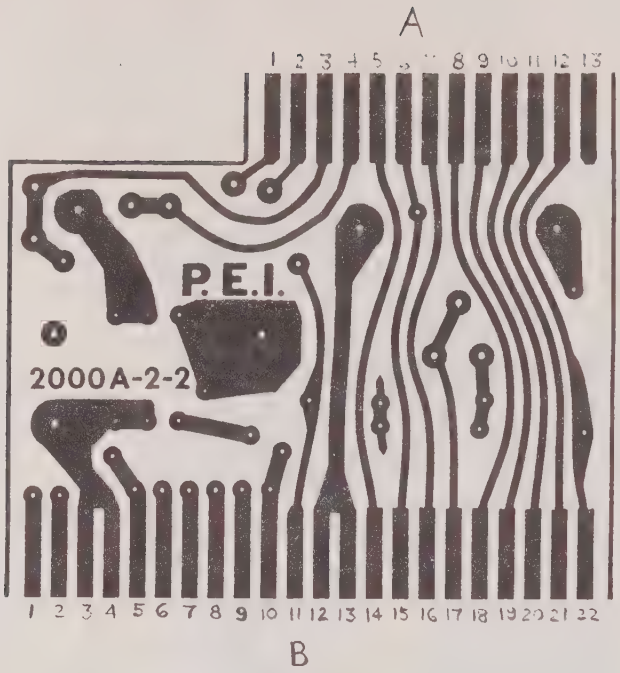
JUMPERS INSTALLED	CASE TO GROUND TEST METHOD
A and C	Red test probe is used to contact EUT case metal with ground intact. Must depress the OPEN GRD switch for measurement with an open ground to EUT.
C only	Red test probe is used to contact EUT case metal with the ground automatically disconnected from EUT.
B only	Red test probe is not required. Measures value of leakage by placing the load and meter directly in the ground path of the EUT.



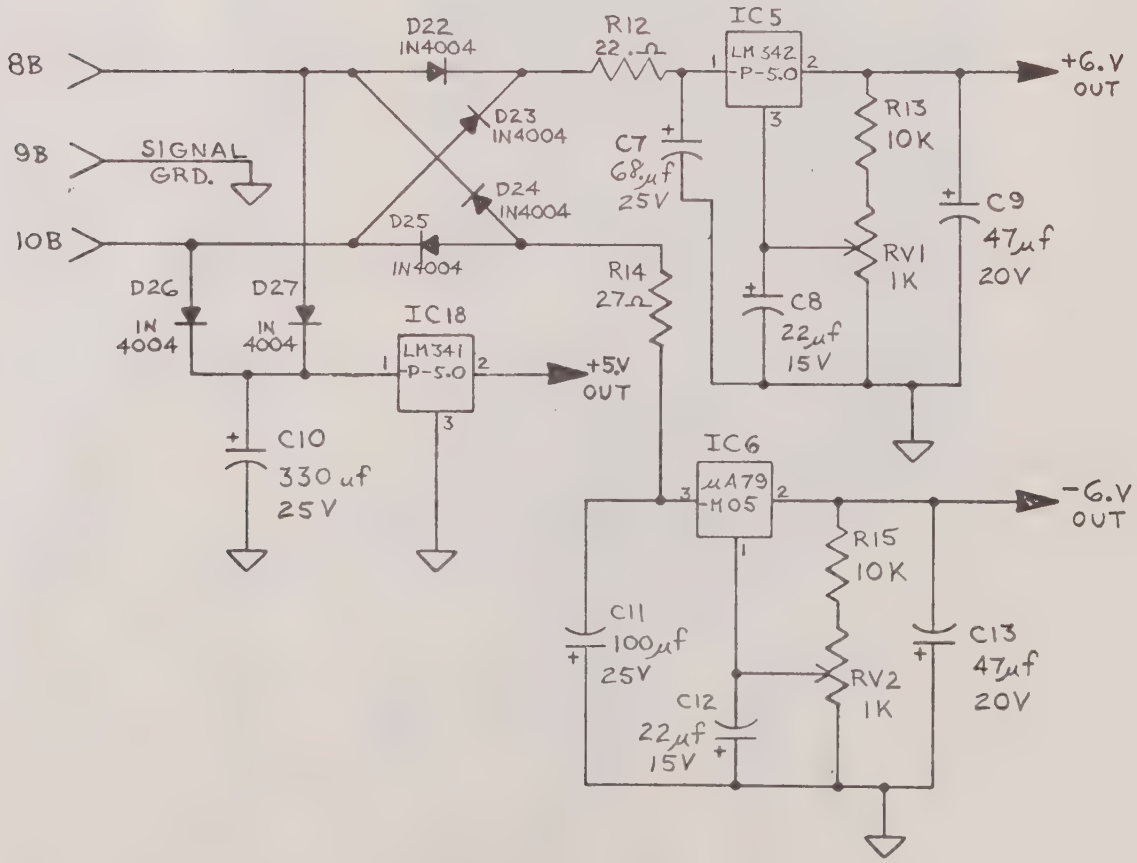
5-2. FUNCTION SWITCH BOARD WIRING (foil side view)



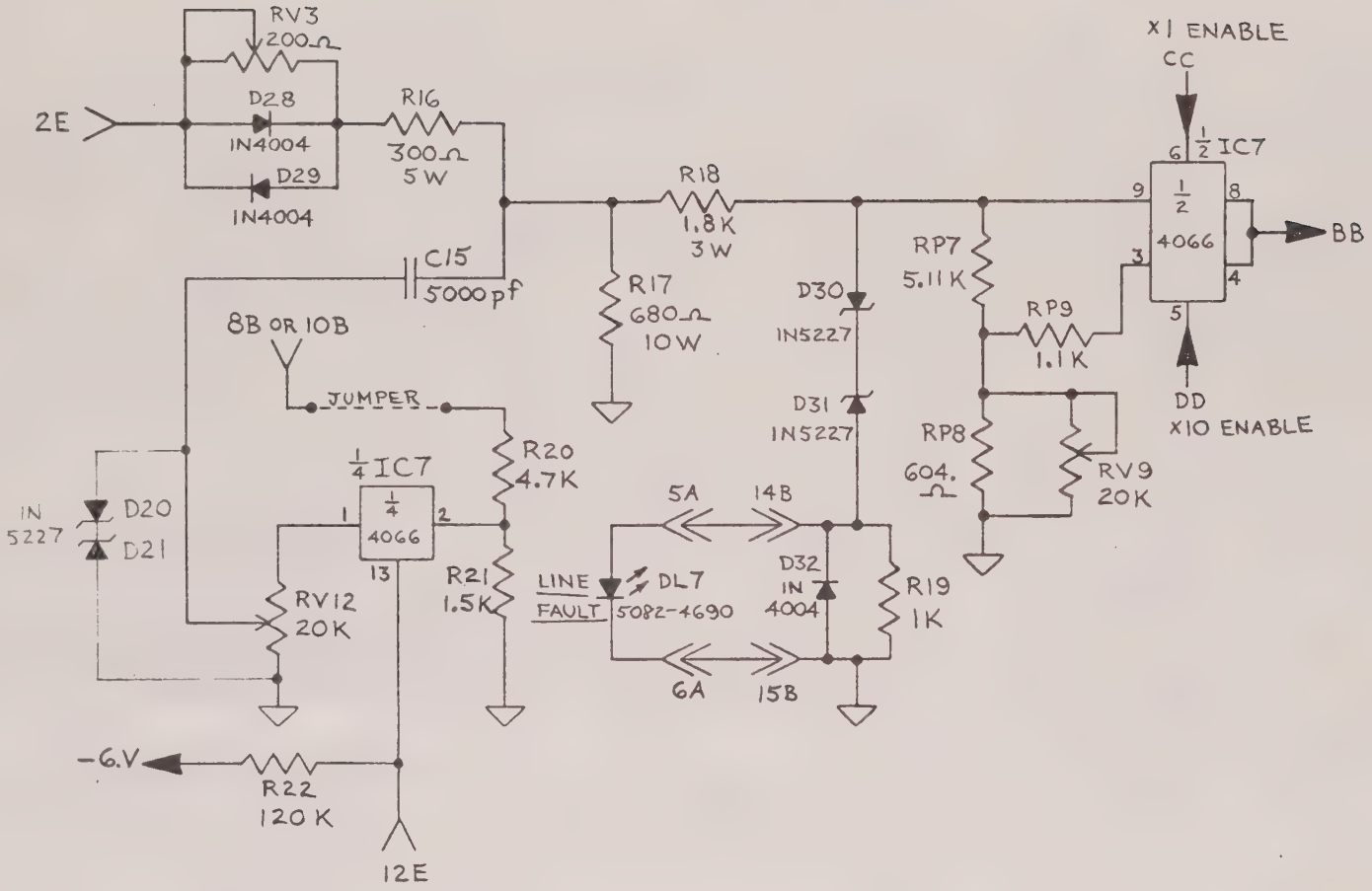
5-3. POWER MODULE WIRING



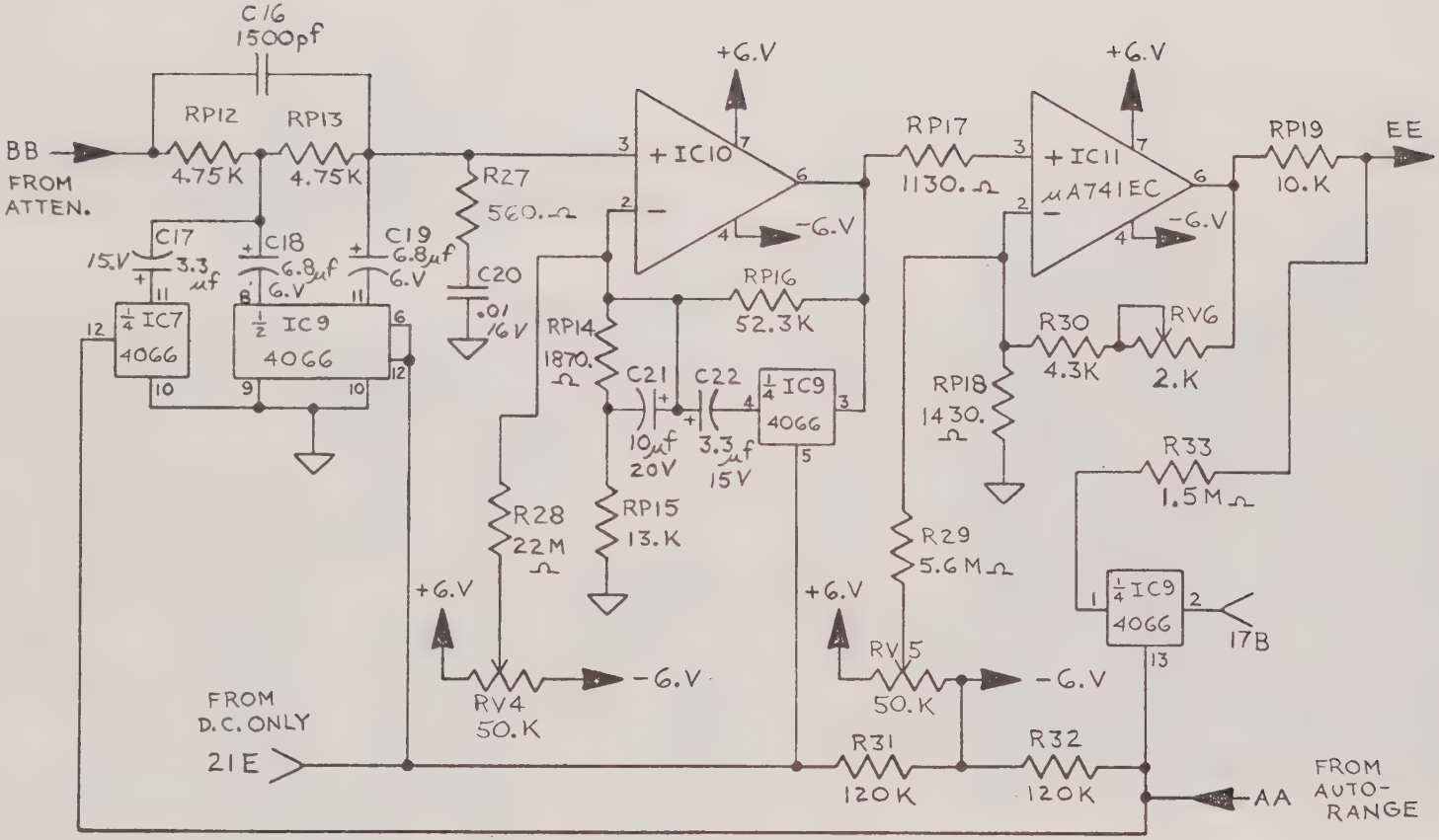
JUNCTION BOARD PIN LOCATIONS (foil side view)



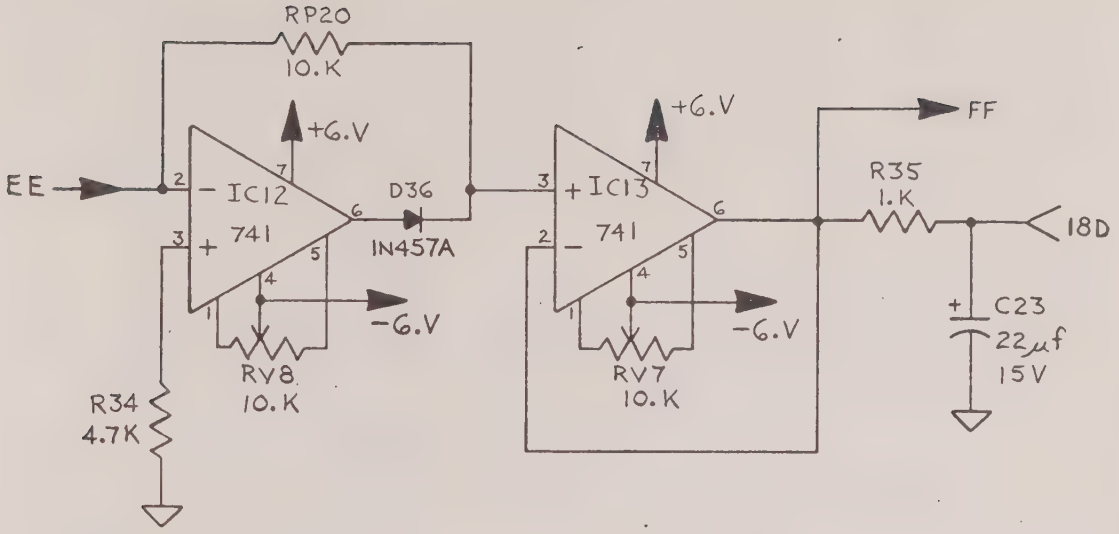
5-5. TRIPLE OUTPUT POWER SUPPLY



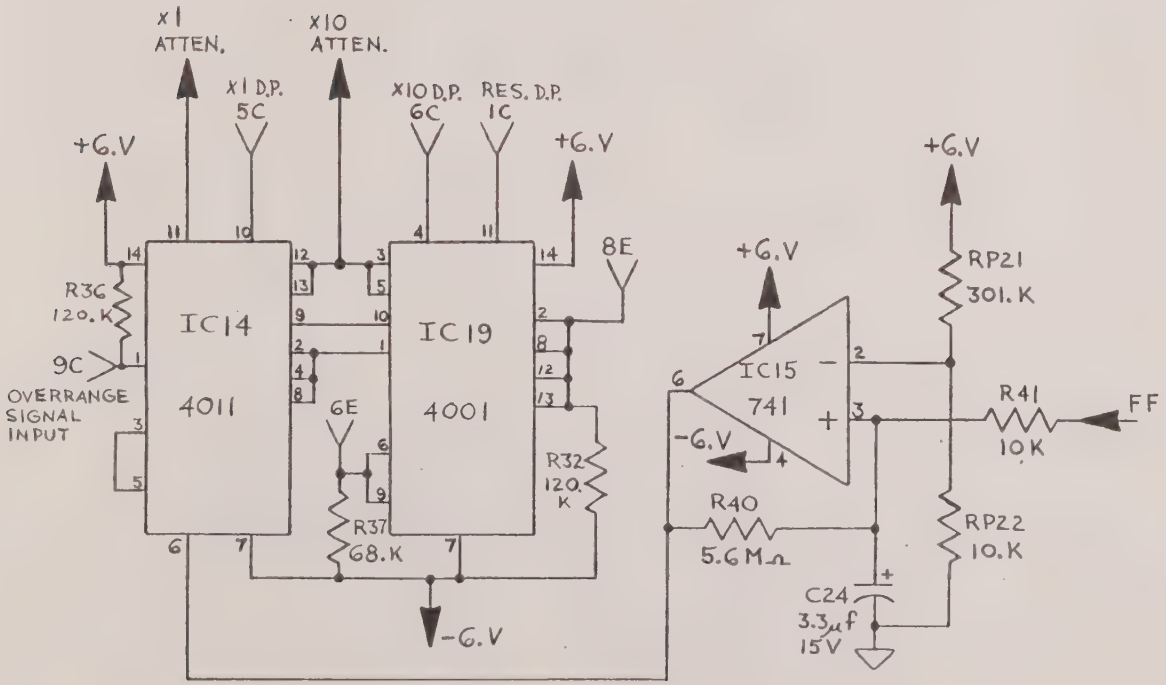
5-3. AUTO-SWITCHED INPUT ATTENUATOR



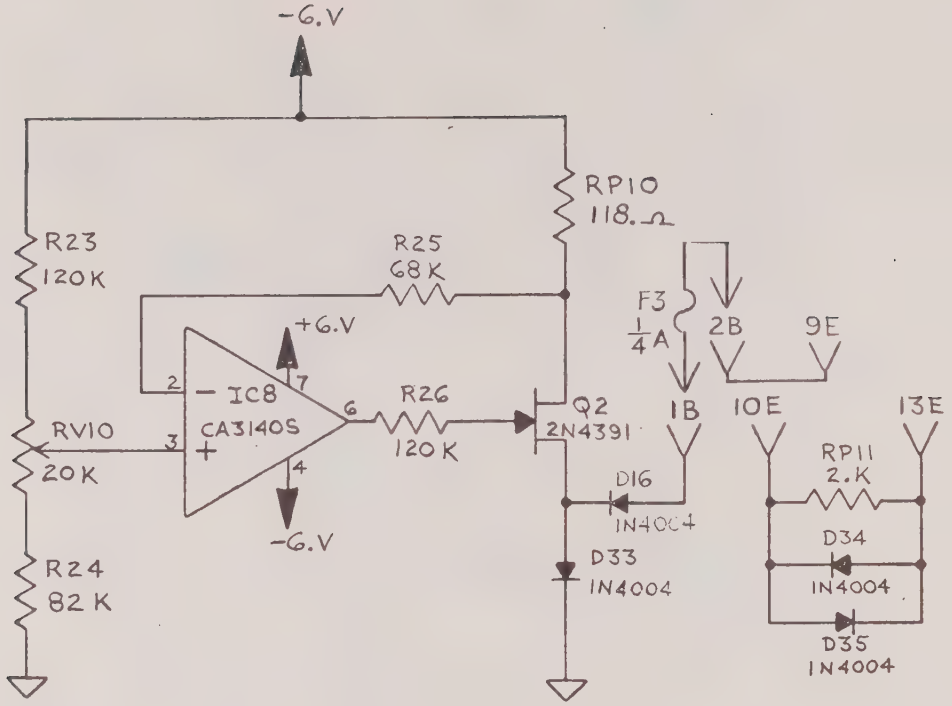
5-7. FAST RESPONSE AMPLIFIER



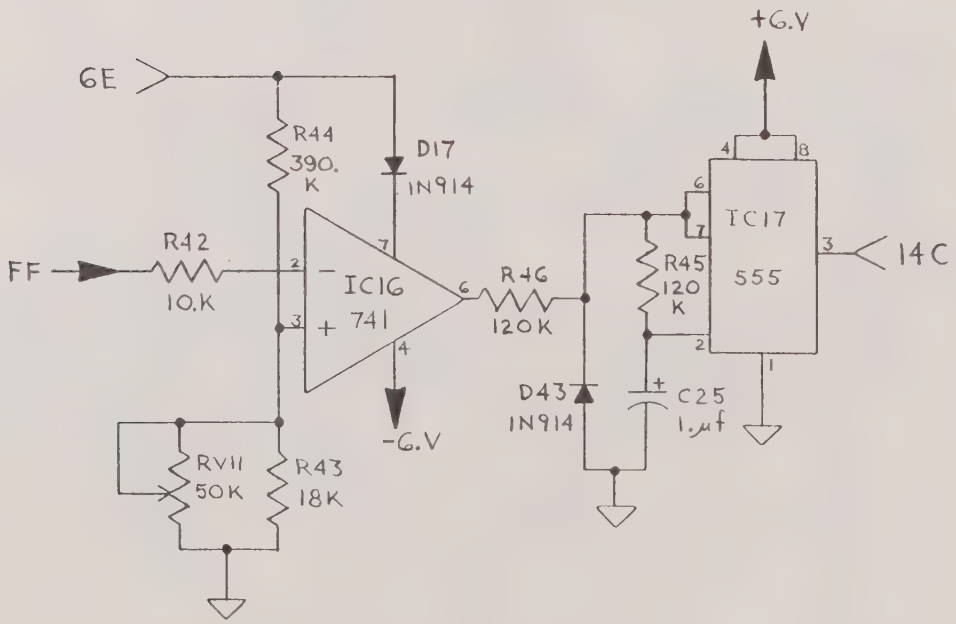
5-7. FAST RESPONSE AMPLIFIER (Contd.)



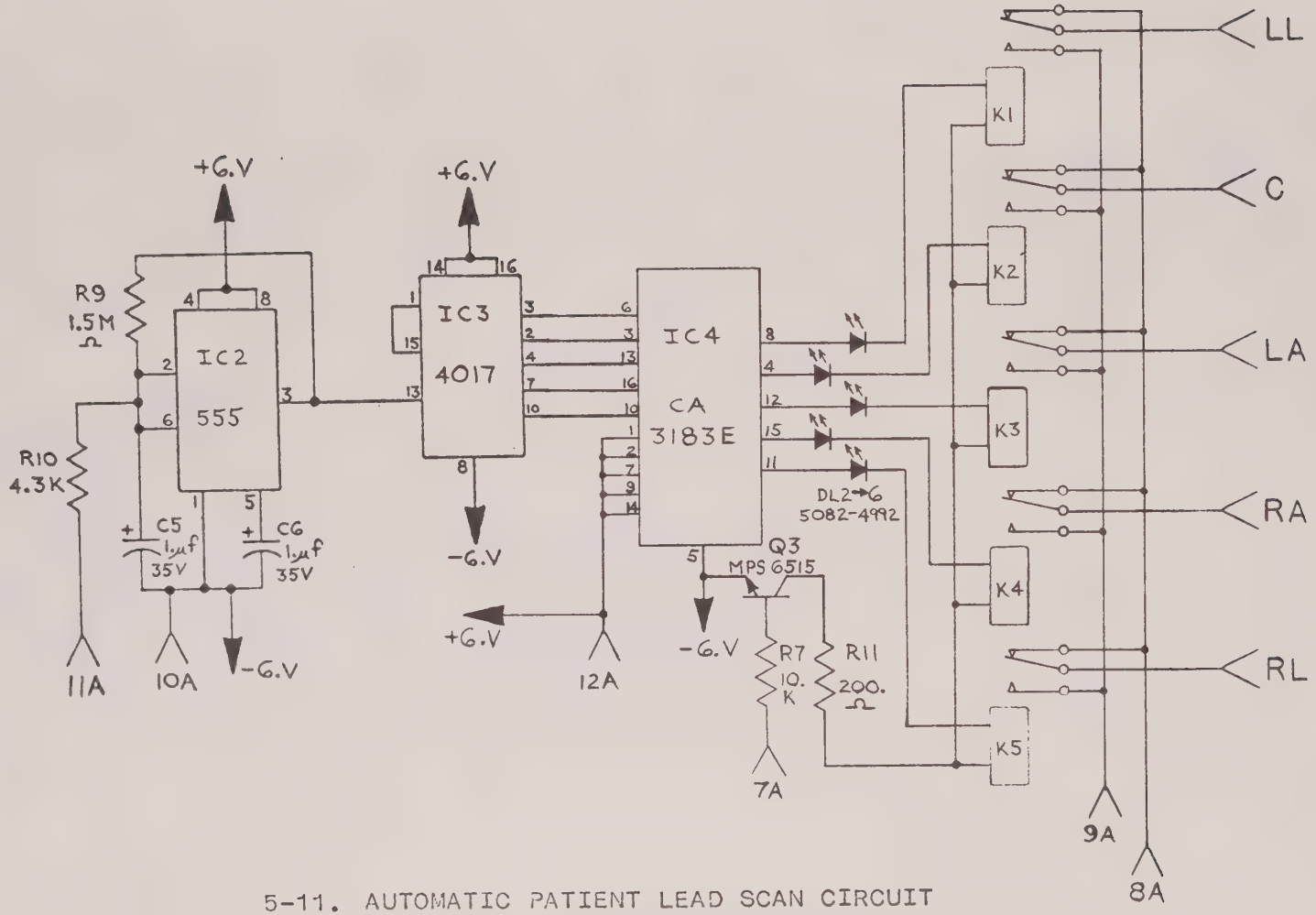
5-8. AUTO-RANGE CIRCUITRY



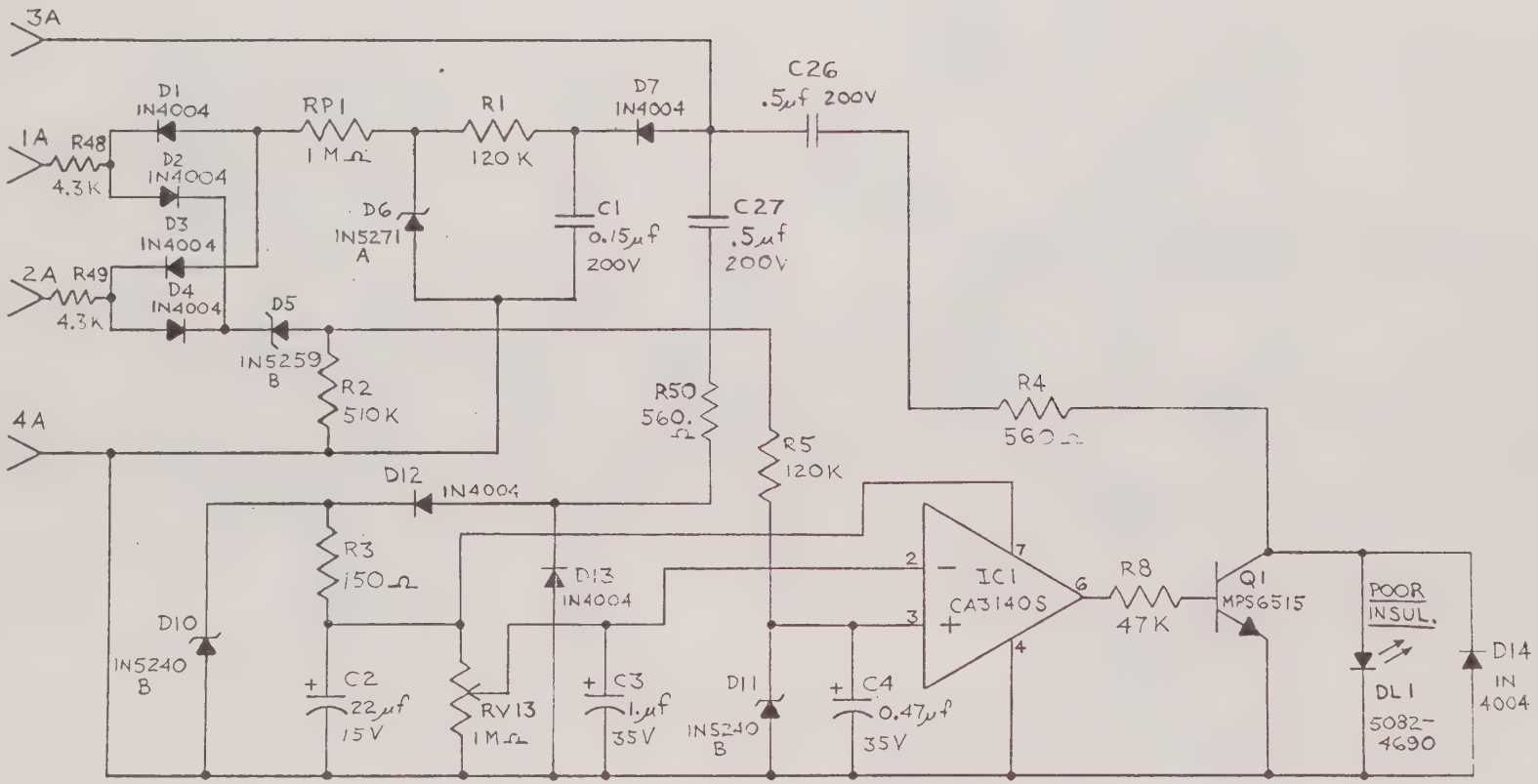
5-9. RESISTANCE TEST CURRENT SOURCE



5-10. LINE TEST "FAIL" INDICATION CIRCUIT



5-11. AUTOMATIC PATIENT LEAD SCAN CIRCUIT



3-14. INSULATION TEST CIRCUIT

REF SYM	P.E.I. PART NO.	DESCRIPTION	MFG	MFG NO.
D17, D43, D44, D45	202	Switching Diode	FAIR	1N914
D20, D21, D30, D31	203	3.3V Zener Diode	FAIR	1N5227
D36	214	Signal Diode	FAIR	1N457A
DR1	212	Reference Diode	INT	ICL8069CCQ
DL1, DL7	210	Red LED	H.P.	5082-4690
DL2, DL3, DL4, DL5 DL6	211	Green LED	H.P.	5082-4992
DSP1	209	½Digit LED Display	H.P.	HDSP-3736
DSP2, DSP3, DSP4	208	7 Segment LED Display	H.P.	HDSP-3731
C1	136	Film, .15 uF, 200V	SPR	192P15492
C2, C8, C12, C23	152	Tant, 22 uF, 15V	KEM	T390D226K016AS
C3, C5, C6, C25	156	Tant, 1. uF, 35V	KEM	T390B105K035AS
C4	155	Tant, 0.47 uF, 35V	KEM	T390A474K035AS
C7	149	Elec, 68 uF, 25V	SPR	EV1327
C9, C13	154	Tant, 47 uF, 20V	KEM	T390E476K025AS
C10	148	Elec, 330 uF, 25V	SPR	EV1345
C11	146	Elec, 100 uF, 25V	CDE	PC 100-25
C15	143	CER, 5000 pF, 1000V	CEN	DD-502
C16	142	CER, 1500 pF, 1000V	CEN	DD-152
C17, C22, C24	151	Tant, 3.3 uF, 15V	KEM	T390B335K016AS
C18, C19	150	Tant, 6.8 uF, 6V	KEM	T390B685K006AS
C20	140	CER, .01 uF, 16V	CEN	UK16-103
C21, C32	153	Tant, 10. uF, 20V	KEM	T390C106K025AS

REF SYM	P.E.I. PART NO.	DESCRIPTION	MFG	MFG NO.
R11, R56, R57	55	200Ω, 5%, ¼W, Comp	TRW	GBT¼
R12	51	22.Ω, 5%, ¼W, Comp	TRW	GBT¼
R14	52	27Ω,5%, ¼W, Comp	TRW	GBT¼
R16	101	300Ω, 5W, Power Resistor	OHM	995-5B
R17	102	680Ω, 10W, Power Resistor	OHM	995-10A
R18	59	1.8K, 3W, Power Resistor	OHM	995-3A
R19, R35	57	1.K, 5%, ¼W, Comp	TRW	GBT¼
R20, R34	61	4.7K, 5%, ¼W, Comp	TRW	GBT¼
R21	58	1.5K, 5%, ¼W, Comp	TRW	GBT¼
R24, R55	68	82K, 5%, ¼W, Comp	TRW	GBT¼
R25, R37	67	68K, 5%, ¼W, Comp	TRW	GBT¼
R28	76	22.MΩ, 5%, ¼W, Comp	TRW	GBT¼
R29, R40	75	5.6MΩ, 5%, ¼W, Comp	TRW	GBT¼
R44	71	390K, 5%, ¼W, Comp	TRW	GBT¼
R47	63	15.K, 5%, ¼W, Comp	TRW	GBT¼
RN1	50	18.K or 20.K, Res. Network	A.B.	314B-183
RN2	49	1.K, 2%, Res. Network	A.B.	314B-102
RP1	24	1MΩ, 1%, Precision Res.	A.B.	CC Series
RP2	21	187.K, 1%, Precision Res.	TRW	GBT¼
RP3	23	412.K, 1%, Precision Res.	A.B.	CC Series
RP4	25	10.MΩ, 1%, Precision Res.	A.B.	CC Series
RP5, RP6	26	1.Ω, 1%, Precision Res.	DALE	DC 1/8
RP7	13	5.11K, 1%, Precision Res.	TRW	RN55D
RP8	2	604.Ω, 1%, Precision Res.	TRW	RN55D
RP9	6	1.1K, 1%, Precision Res.	TRW	RN55D
RP10	1	118.Ω, 1%, Precision Res.	TRW	RN55D

6 - 1. ORDERING INFORMATION

To place an order or to obtain information concerning replacement parts, contact our service department at P.E.I., Inc. When ordering, include the following information:

A. Instrument Model Number
B. Instrument Serial Number
C. Part Description
D. Reference Symbol (if applicable)

6 - 2. CROSS REFERENCE OF MANUFACTURERS

ABBREV.	MANUFACTURERS
A.B.	Allen Bradley
BEC	Beckman
BOU	Bournes
C.C.	Coto Coil
CDE	Cornell-Dubilier
CEN	Centralab
DALE	Dale
FAIR	Fairchild
H.P.	Hewlett Packard
INT	Intersil
KEM	Kemet
MOT	Motorola
NAT	National Semiconductor
OHM	Ohmite
PMI	Precision Monolithics
RCA	Radio Corporation of America
SIG	Signetics
SPR	Sprague
TRW	TRW

REF SYM	P.E.I. PART NO.	DESCRIPTION	MFG	MFG NO.
IC1, IC8	248	BIMOS OP-AMP	RCA	CA3140S
IC2, IC17	244	Timer	SIG	NE555P
IC3	251	5 Stage Johnson Counter	FAIR	4017
IC4	249	5 Transistor Array	RCA	CA3183E
IC5	241	Regulator, +5V, 250 mA	NAT	LM342P-5.0
IC6	239	Regulator, -5V, 500 mA	FAIR	uA79M05AUC
IC7, IC9	246	Quad Bilateral Switch	MOT	4066
IC10	247	Precision OP-AMP	PMI	OP-07
IC11, IC12, IC13, IC15, IC16, IC21, IC22	245	OP-AMP	NAT	uA741EC
IC14	250	Quad 2 Input Nand Gate	FAIR	4011
IC18	240	Regulator, +5V, 500 mA	NAT	LM341P-5.0
IC19	252	Quad 2 Input NOR Gate	FAIR	4001
IC20	253	Single Chip DPM	INT	ICL7107CPL
Q1, Q3	198	NPN Transistor	MOT	MP56515
Q2	200	Field Effect Transistor	MOT	2N4391
D1, D2, D3, D4	213	1A, 1000V Rect. Diode	FAIR	1N4007
D5	205	39V Zener Diode	MOT	1N5259B
D6	206	100V Zener Diode	MOT	1N5271A
D7, D12, D13, D14, D15, D16, D22, D23, D24, D25, D26, D27, D28, D29, D32, D33, D34, D35	201	1A, 400V Rect. Diode	FAIR	1N4004
D10, D11	204	10V Zener Diode	FAIR	1N5240B

REF SYM	P.E.I. PART NO.	DESCRIPTION	MFG	MFG NO.
C26, C27	144	Poly, .47-.56 uF, 200V	CDE	MMW2P47
C28	141	Mica, 100 pF, 500V	SPR	MWA-101
C29, C30	137	Film, .1 uF, 80V	SPR	192P1049R8
C31	145	Poly, .22 uF, 100V	CDE	WMF1P22
RV1, RV2	181	1.K Multi-Turn Pot.	BOU	3006P-1-102
RV3	172	200Ω Single Turn Pot.	BOU	3386W1-201
RV4, RV5, RV11	177	50.K Single Turn Pot.	BOU	3386W1-503
RV6	174	2.K Single Turn Pot.	BOU	3386W1-202
RV7, RV8	175	10.K Single Turn Pot.	BOU	3386W1-103
RV9, RV10, RV12, RV15	176	20.K Single Turn Pot.	BOU	3386W1-203
RV13	178	1.MΩ Single Turn Pot.	BEC	72PMR
RV14	179	2.MΩ Single Turn Pot.	BEC	72RMR
R1, R5, R22, R23, R26, R31, R32, R36, R45, R46, R52	69	120K, 5%, ¼W, Comp	TRW	GBT¼
R2, R51	72	510K, 5%, ¼W, Comp	TRW	GBT¼
R3	54	150Ω , 5%, ¼W, Comp	TRW	GBT¼
R4, R27 R50	73	560.Ω , 5%, ¼W, Comp	TRW	GBT¼
R6, R43	64	18K, 5%, ½W, Comp	TRW	GBT
R7, R13, R15, R41, R42	62	10K, 5%, ¼W, Comp	TRW	GBT¼
R8	66	47K, 5%, ¼W, Comp	TRW	GBT¼
R9, R33	74	1.5MΩ , 5%, ¼W, Comp	TRW	GBT¼
R10, R30, R48, R49, R53, R54	60	4.3K, 5%, ¼W, Comp	TRW	GBT¼

REF SYM	P.E.I. PART NO.	DESCRIPTION	MFG	MFG NO.
RP11	10	2.K, 1%, Precision Res.	TRW	RN55D
RP12, RP13	12	4.75K, 1%, Precision Res.	TRW	RN55D
RP14	9	1870.Ω , 1%, Precision Res.	TRW	RN55D
RP15	16	13.K, 1%, Precision Res.	TRW	RN55D
RP16	19	52.3K, 1%, Precision Res.	TRW	RN55D
RP17	7	1130.Ω ,1%, Precision Res.	TRW	RN55D
RP18	8	1430.Ω , 1%, Precision Res.	TRW	RN55D
RP19, RP20, RP22	5	10.K, 1%, Precision Res.	TRW	RN55D
RP21	22	301.K, 1%, Precision Res.	TRW	RN55D
K1, K2, K3, K4, K5	216	SPDT REED RELAY	C.C.	CR-4010-6-1

OPERATING INSTRUCTIONS

MODEL 201A

PREPARATION FOR USE

1. Insert the 2000A power plug into the isolated power system receptacle.
2. Place the polarity switch of the 2000A in the center "off" position.
3. Depress the PROBES EXT. function switch of the 2000A.
4. Position toggle switch of the 201A to LEAKAGE position.
5. Plug the 201A module into the 2000A receptacle.
6. Plug the double bananna test lead of the 201A into the "probe jacks" of the 2000A with ground side of test lead to black bananna jack.

CAUTION DISCONNECT ALL PATIENTS FROM EQUIPMENT THAT IS PLUGGED INTO THE ISOLATED POWER SYSTEM UNDER TEST

OPERATING INSTRUCTIONS

LINE 1. LEAKAGE TO GROUND.

1. Position "LEAKAGE/TRIP" toggle switch on the 201A to LEAKAGE position.
2. Place the receptacle switch of the 2000A to LINE 1. position.
3. Push momentary READ switch of the 201A up and read the current in mA on the 2000A digital display.

Note: The audible alarm should sound during this test when the READ switch is pushed.

When the READ switch of the 201A and the LINE TEST switch of the 2000A are pressed simultaneously voltage from Line 1. to Line 2. is displayed on the 2000A. With switch setting other than those above this voltage test is not valid.

LINE 2. LEAKAGE TO GROUND

1. Position "LEAKAGE/TRIP" toggle switch on the 201A to LEAKAGE position.
2. Place the receptacle switch of the 2000A to LINE 2. position.
3. Push momentary READ switch of the 201A up and read the current in mA on the 2000A digital display.

Note: The audible alarm should sound during this test when the READ switch is pushed.

LINE 1. TRIP ALARM CURRENT TO GROUND

1. Turn TRIP CURRENT knob of 201A fully counterclockwise.
2. Position "LEAKAGE/TRIP" toggle switch of the 201A to TRIP position.
3. Place the receptacle switch of the 2000A to LINE 1. position.
4. Turn the TRIP CURRENT knob on the 201A clockwise until the audible alarm of the line isolation monitor is heard.
5. Silence alarm.
6. Push momentary READ switch of 201A up and read alarm trip current in mA on the 2000A digital display.

LINE 2. TRIP ALARM CURRENT TO GROUND

1. Turn TRIP CURRENT knob of 201A fully counterclockwise.
2. Position "LEAKAGE/TRIP" toggle switch of the 201A to TRIP position.
3. Place the receptacle switch of the 2000A to LINE 2. position.
4. Turn the TRIP CURRENT knob on the 201A clockwise until the audible alarm of the line isolation monitor is heard.
5. Silence alarm.
6. Push momentary READ switch of 201A up and read alarm trip current in mA on the 2000A digital display.

GENERAL INFORMATION

The Model 201A, Iso-Power Test Module, when used with the Model 2000A verifys the proper functioning of an isolated power system and its' monitor. Trip current and leakage current from either line to ground is read directly in milliamperes on the Model 2000A digital display.

TEST SPECIFICATIONS

LEAKAGE OF LINE 1. OR LINE 2.

Range: 0 - 125 mA.

Toggle switch programs test.

Receptacle switch programs line selection.

Accuracy: ± (2.0% reading + 1 digit)

TRIP CURRENT OF LINE 1. OR LINE 2.

Range: 0.5 - 5.0 mA

Toggle switch programs test.

Receptacle switch programs line selection.

Trip current adjusted with single turn control knob.

Accuracy: ± (2.0% reading + 1 digit)

Readings for both LEAKAGE and TRIP CURRENT accomplished by pressing a momentary toggle switch.

GENERAL SPECIFICATIONS

TEST LEAD

Double bananna, 5.0" long.

MALE PLUG

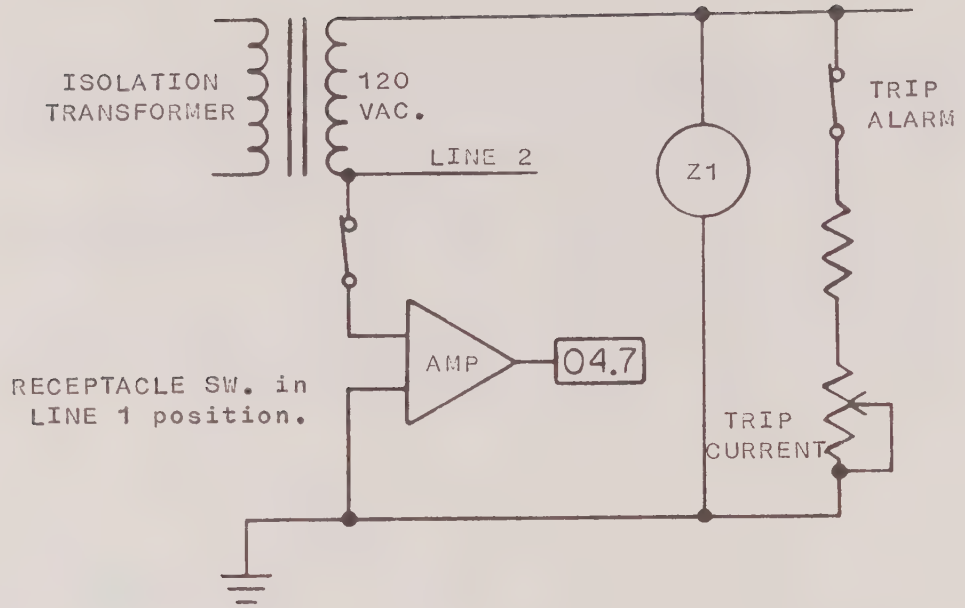
Test box mounted.
Two prong with U-blade ground.

PHYSICAL

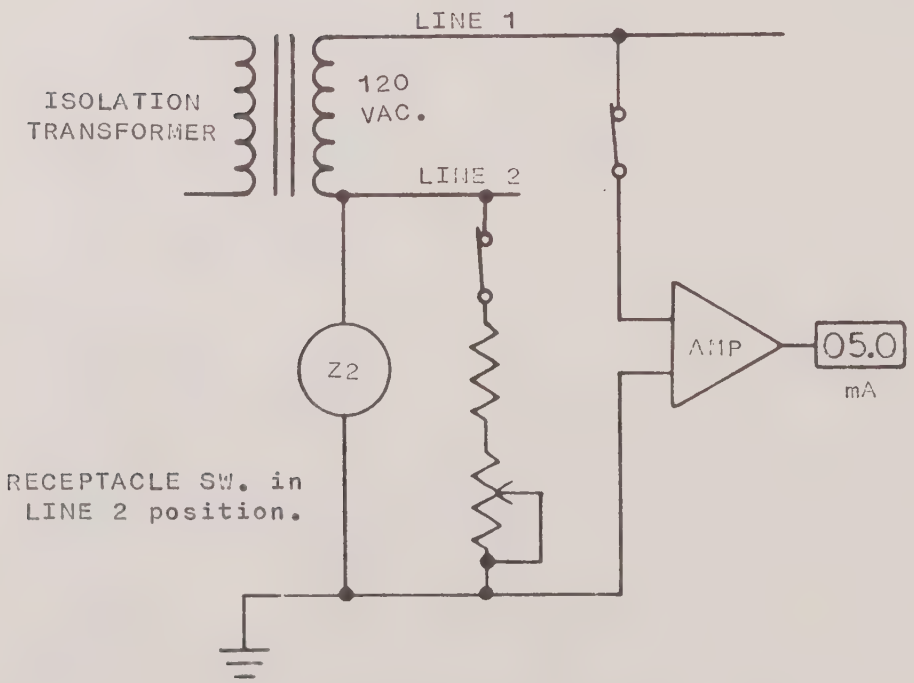
Case of aluminum.
Weight: 8 oz. approx.
Size: 4.0" long X 2.0" wide X 1.5" high.

GFI TRIP ALARM CURRENT/GFI OPTION ONLY

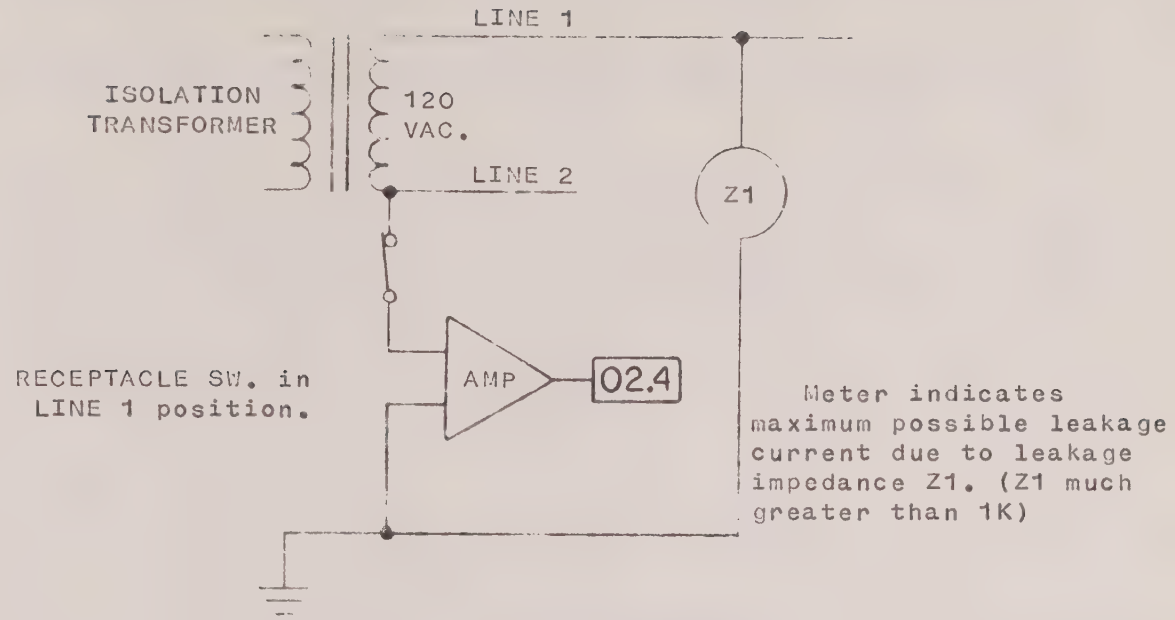
1. Turn TRIP CURRENT knob of 201A fully counterclockwise.
2. Place the receptacle switch of the 2000A to LINE 1. position.
3. Depress and hold the momentary GFI switch.
4. Slowly rotate the trip current knob of 201A clockwise and read the trip current in ma when the GFI interrupts.



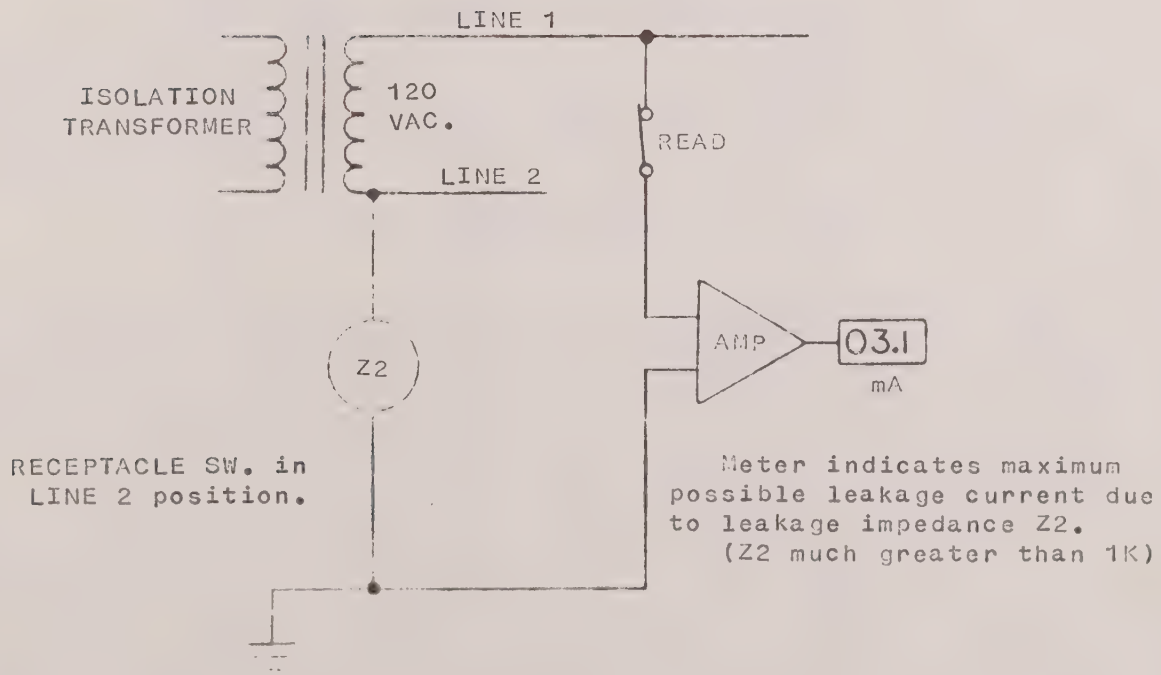
LINE 1. TRIP ALARM CURRENT TO GROUND



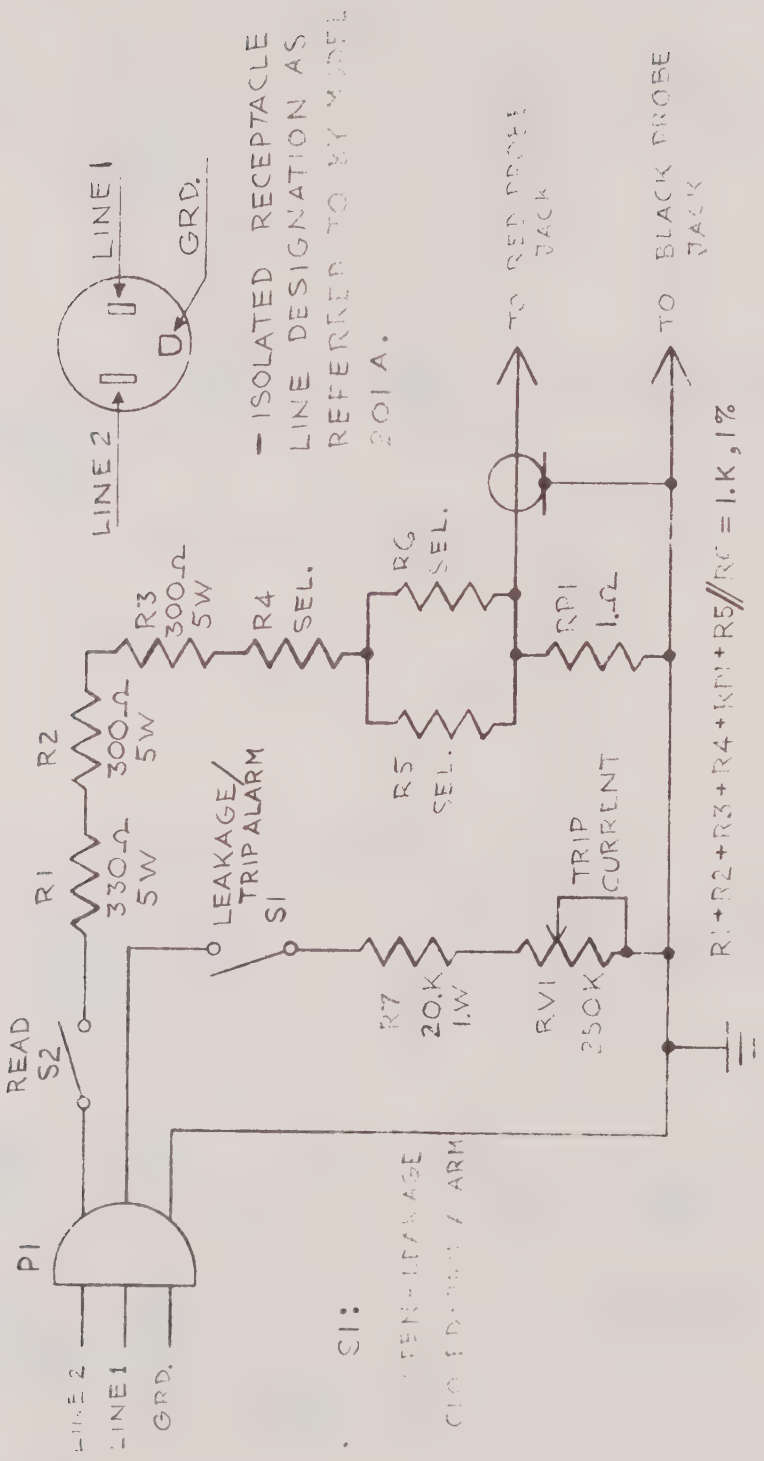
LINE 2. TRIP ALARM CURRENT TO GROUND



LINE 1. LEAKAGE TO GROUND



LINE 2. LEAKAGE TO GROUND


LINE 1
GRD.
LINE 2
ISOLATED RECEPTACLE
LINE DESIGNATION AS
REFERRED TO BY MODEL
201A.
R3
300Ω
5W
R4
SEL.
R6
SEL.
R5
SEL.
RP1
1.Ω
R2
300Ω
5W
R1
330Ω
5W
LEAKAGE/
TRIP ALARM
S1
TRIP
CURRENT
R7
20.K
1.W
RV1
250K
READ
S2
P1
LINE 2
LINE 1
GRD.
TO BLACK PROBE
JACK
R1+R2+R3+R4+RP1+R5//R6 = 1.K, 1%

DAMAGE & SHORTAGE

Before you fully unpack any unit READ THIS for your protection

(THIS INFORMATION APPLIES ONLY ON SHIPMENTS WITHIN THE UNITED STATES)

DAMAGE This shipment was packaged and delivered to the carrier with the utmost care to insure safe delivery of goods. When shipment is received and signed for by the transportation company, consignor's responsibility ceases. Do not accept shipment which evidences damage or shortage until agent of carrier endorses a statement of the irregularity on the face of the transportation receipt. Without documentary evidence, claim cannot be filed.

CONCEALED DAMAGE Interstate Commerce Commission has indicated that a carrier is as much responsible for concealed damage as for visible damage in transit. Upon receipt of shipment, promptly unpack and check thoroughly. If concealed damage is discovered, cease further unpacking and request immediate inspection by local agent of carrier. A written report of the agent's findings, with his signature, is necessary to support claim.

SHORTAGE Check shipment against shipping papers. Do not discard packing materials or packing cases until contents have been found to be correct. The removal of badly needed items, before shipment has been checked, may create a shortage. Check all possibilities before reporting a shortage.

CLAIMS If your agent or carrier has been given an opportunity to inspect the shipment, any claim for a shortage or damaged merchandise can be handled as a simple and routine procedure. Claims must be filed by consignee. Shipping terms are f.o.b. Carson City, Nevada.

LOSS In the event of complete loss, claim will be handled in the same manner as for Shipping Damage or Shortage.

**Note further information below.*

SHIPPING DAMAGE OR SHORTAGE

AIR FREIGHT – Claim must be initiated at point of destination. Claim must be filed by submitting a letter on company stationery with an explanation of the extent of damage or loss and forwarded with a copy of the original* air bill, and original invoice or photostat of same, to the airline having carried the shipment.

*Upon request certified photostatic copies of original papers held by Dynatech-Nevada required in support of port of claims will be made available.

PARCEL POST / UPS

PLACING CLAIM FOR DAMAGE – For those shipments insured by Parcel Post, the addressee initiates the claim by filling out Post Office Dept. Form 3812, "Request for Payment of Domestic Postal Insurance". Item 12 is to be other than Dynatech-Nevada. Damaged material must be returned to the Post Office of address for inspection. A new purchase order is required by Dynatech-Nevada to cover the cost of repairs (or in the case of loss or refiling-replacement order). Damaged material will be repaired and returned. Party named in item 12 of form 3812 will receive reimbursement for repair cost from Post Office Department.

PLACING CLAIM FOR LOSS – In the event of a report to consignor of loss or refiling, Post Office Dept. Form 3812 will be initiated by Dynatech-Nevada at point of origin. If, after Post Office investigation, the material is not located, disposition from this point will be the same as stated in the above paragraph—"Placing claim for damage."

PLACING CLAIM FOR DAMAGE TO SHIPMENTS BY UNITED PARCEL—The addressee must notify Dynatech-Nevada , who will notify United Parcel Service giving the shipper's number and date parcel was shipped. United Parcel Service will send a representative to inspect the damage and advise proper disposition. A new purchase order is required by Dynatech-Nevada to cover the cost of repairs or in the case of loss or refiling, a replacement order. Damaged material will be repaired and returned.

DYNATECH NEVADA
INCORPORATED

Formerly NEURODYNE-DEMPSEY

2000 ARROWHEAD DRIVE, P.O. BOX 1925, CARSON CITY, NEVADA 89701 (702) 883-3400

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MP MASTER
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